The
Electrical Review

VOL. CXVIII. JANUARY 3, 1936. No. 3032.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Waterloo 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Index to Advertisers—Page xl. Classified Advertisements-Official Notices-Tenders—Supp. 19.

Principal Contents:

	PAGE
Electrical Measurement	1
Modern Meters and Time Switches	3
Conversion to Public Supply. By F. Morgan	8
Instrument Manufacture	9
Tolerances on Guarantees. By E. T. Norris	15
Hydraulic Turbine Control. By F. Johnstone Taylor	17
Applications of the Thyratron	18
Industrial Research	18
Correspondence: Heating and Ventilation; Railway Signalling; Measuring Cables; Multiple Earthing	19
Notes on Water Heaters. By F. D. Parker	20
New Apparatus and Devices	21
Manufacturers' Activities in 1935	22
Giants in the Brickmaking Industry	24
New Books	24
Argentine Electrical Imports in 1934	25
Business and Industrial Notes	26
Electricity Supply	30
Traction	32
Communications	32
Contract Information	33
Notes	34
Our Personal Column	35
Financial Section	36
Patent Specifications	39
New Work for Contractors	40

Electrical Measurement

EVEN if electricity were supplied as water is on a periodic lump-sum charge, meters would still be required to give us essential information regarding the working of our plant. We see few signs that such a tariff is likely to come into use in this country, and, indeed, the use of energy meters is general in water-power countries, where costs that vary with the amount of energy taken are almost negligible. The importance of electrical instruments is rated more highly than it ever was, and the meter superintendent now has more nearly the status which his work merits.

Certainly the activities of our manufacturers evince no fear of a meterless Utopia, and a very important feature of the work of the National Physical Laboratory during the last year or two has been the testing of prepayment meters for two-part tariffs.

Official experience thus agrees with our own more recent investigations, the results of which are given on a later page. Our review shows that developments are almost entirely mechanical, the electrical end leaving little room for improvement having regard to the sub-standard accuracy of meters offered for commercial uses and the consistency of performance at all loads under working conditions.

To the latter the work of the British Scientific Instrument Research Association has largely contributed by its investigations into bearings and their lubrication, and in view of the wide range of loading over which close accuracy is obtainable there would appear to be little justification for the number of ampere sizes now on the market.

There should be no cause to doubt the registration of the modern meter, especially when one recalls the well-equipped test-rooms established by many undertakings and the existence of public laboratories for the others. The problem raised at East Ham recently regarding "certified" meters and the duties of an independent inspector should, therefore, be capable of solution on commercial lines at little expense.

It would be a mistake, however, to regard meters merely as a means for the making out of accounts to consumers. To generation and distribution engineers they provide the means without which power-stations would not have achieved their high efficiencies and without which little would be known about diversity factor, upon which load-inducing tariffs are so largely based.

Similar elaboration of measurement could well be applied in a much greater degree to industrial processes than it now is for checking stages in production, ascertaining the cost of each department, recording the time taken on individual operations, improving power factor and keeping down the maximum demand.

Adding to efficiency in these and in many other ways is not only serviceable to the works manager; it also provides a strong point in favour of the use of electricity instead of other methods of doing the same thing.

Innumerable cases will be found in works all over the country in which the cost of appropriate electrical instruments is a mere fraction of the economies to be obtained by their aid. Some good types of such instruments are to be found at the Physical Society's Exhibition, a review of which is given in this issue.

These examples of fine work well maintain the leading position of British products of this type, and their potentialities for encouraging the greater use of electricity by the paradox of its more efficient utilisation will well repay all the thought that can be concentrated on them.

Live Research

A GRATIFYING feature of the report of the Department of Scientific Research for 1934-35, which was issued this week, is the indication provided of a greater realisation among industrialists of the practical value of science (of course including electrical science) at every stage of their processes. Our own industry is in the van, and the income of the Electrical Research Association has increased from £44,000 to £64,000 during the past two years. The

record of recent work of that body and of the Electricity Department of the National Physical Laboratory gives a reliable summary of the main problems that are engaging the immediate attention of electrical engineers, among which field studies of surge phenomena, earthing, and broadcasting interference stand out. Many matters of actual or potential electrical significance are scattered throughout other sections of the report. Thus, the burning of substantial proportions of pulverised coal in stable suspension in oil is likely to have a bearing on methods of generation. While the part dealing with furnaces does not relate specifically to those of the electric type, it contains an appreciation of the greater importance now attached to radiated (as distinct from convected) heat, and this should favour electrical methods. Such indications, and others less obvious, of the scope for electricity give the report a stimulating character.

Regenerative Control

THE idea of using a traction motor as a generator when the vehicle runs above the speed required was born out of due season thirty or forty years ago, but it has been revived during recent years to give a new lease of life to the tramcar. It is also proving a notable factor in deciding that the trolley bus shall succeed the tramcar in places where low traffic density and cost of track renewals have decreed the end of the rail system. Regenerative control of trolley buses, which was first introduced at Wolverhampton in 1926, was one of the outstanding features of the recent Commercial Motor Show (ELECTRICAL REVIEW, November 15th). The advantages, which include a possibility of saving from 15 to 30 per cent. in energy consumption, and an even larger amount of brake wear, have caused firms which have long made petrol buses, and now also build trolley as well as Diesel buses, to place the electric vehicle easily first for urban transport in passenger comfort as well as in overall economy.

Bulk Heating

FULL economic advantages of warming a new building by electricity are attained only if the heating system is allowed for in the initial design. Elimination of chimneys and flexibility in temperature control are among the factors that free the architect from restrictions and enable him to make the utmost use of his space. The new E.D.A. brochure "Heat to Measure" has evidently been prepared with one eye on the architects. It sets out the case for electricity pictorially with very little printed matter, and contains excellent views of a number of buildings that do not add to the pollution of the atmosphere, concluding with a photograph of the headquarters of the Royal Institution of British Architects, which is electrically heated. The effort is well directed, since it should not be very difficult to demonstrate to the members of that profession that the case for electrical heat is based only to a minor extent on comparisons of B.th.u. per £. Nevertheless, the latter remains a very important consideration, and the line of action necessary to secure the seven-months' building-heating load on a far larger scale and at much lower prices than are at present generally envisaged must be settled before we can grasp opportunities that are continually offering themselves.

Circuit-Breaker Testing

EFFICIENCY in a supply system is largely determined by the ability of its associated switchgear to cope with faults, but this aptitude cannot be forecast from mechanical and electrical characteristics. The great increase in kVA to be interrupted under such conditions, brought about by the use of larger generating sets in interconnected power-stations, has added significance to the short-circuit aspect of switchgear rating. A plant installed by the Switchgear Testing Co. capable of reproducing circuit conditions of almost any degree of severity, in augmentation of the existing resources of the A.E.I. group of companies, gives this country another switchgear proving house for heavy duties. Experience gained by the constituent companies shows that a circuit-breaker which has apparently cleared a short-circuit successfully may yet be condemned by an oscillogram, and the inclusion in the new plant of both electro-magnetic and cathode-ray instruments of advanced design is one of its important features. The cathode-ray oscillograph is able to record even the high-frequency transient re-striking voltage, which has an appreciable effect on the performance of a breaker.

Electric Furnace Progress

NOTWITHSTANDING that the cost of providing gross heat units by coal is a mere fraction of that incurred with electricity, considerable developments in the electric furnace load are taking place all over the world. Notable progress has been made in Germany, where furnaces and ovens in operation at the beginning of last year required an amount of high load-factor energy that is equivalent to more than 40 per cent. of the present total industrial consumption in Great Britain. While the bulk is taken by the large arc and induction installations, there has been during the last couple of years a great increase in the number of smaller furnaces of the resistance type. Further developments in the use of small elements in various ways may, we believe, be expected in the near future.

Earth Resistances

How great may be the variation in earth resistance between different sub-stations is illustrated by an example we came across the other day. At one site the figure was 5 ohms and at another 500 ohms. In the latter case the earth spike was found to have been driven into made-up ground, but it is not always easy to discover what is builders' rubble and what is original soil. The effect of such substances as slaked lime and cement on copper electrodes, and, at a farm, of chemical manures and ammonia, in addition, are all fit subjects for investigation.

The Supply Regulations

THE modified regulations for securing safety and adequacy of supply at present cover all connections made after January 15th, 1934. Their extension to include supplies given before that date has been postponed again, and the operative date has now been fixed at January 1st, 1937. Some of the difficulties of such retrospective legislation were discussed by Mr. J. W. Thomas in our issue of March 2nd, 1934, but in addition to these the Electricity Commissioners hold that a case has been made out for modifying the provisions themselves. Among the amendments that have been considered by various parties are those relating to the minimum kW for a three-phase domestic service, permissible voltage and frequency variations, neon signs, maximum resistance in parallel with the earth switch or fuse on a d.c. neutral and the giving of official notice of a widespread failure of supply. These suggestions and many others like them are important enough to justify the delay, provided that it leads to no uncertainty regarding the effect on work carried out since the date originally proposed.

Patenting the Lily

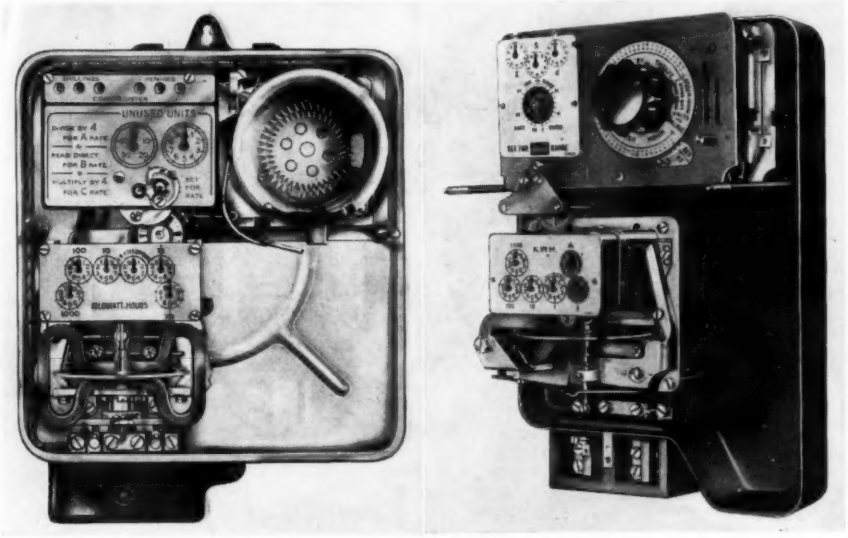
THE American General Electric Co. is reported to have applied for a patent for the cultivation of a lily. This follows upon experiments in the effects of X-rays on lily bulbs. The beauty of the ordinary lily is marred by the bursting of the anthers, which covers the petals in yellow pollen. It was found that after treatment with X-rays the anthers were prevented from opening, but that it was still possible to reproduce the strain, the "descendants" retaining the non-opening anthers. It looks as though the company should corner the American lily market, and, as the Americans are great flower-lovers, it may be found remunerative to abandon the production of power plants in favour of the cultivation of flower plants.

Modern Meters and Time Switches

New ideas and the general trend

WE would summarise modern design and construction developments in house service meters as almost entirely mechanical. There are two main reasons for this: first, we are in the midst of a tariff transition period which is bringing in its train a remarkable extension in the use of the prepayment meter, an extension of which the end is nowhere in sight. And instead of the slowing-down of this activity predicted by some authorities a year or two ago, we have unforeseen acceleration.

British Sangamo Co., Ltd., reports that during the past year its developments have been mainly confined to prepayment meters. Messrs. Ferranti state that during the past year the progress in meter design has been chiefly directed to the extension of the usefulness of meters by the further development of the various mechanisms which are used in conjunction with the metering element proper, and that future development seems to be tending towards designs of meters which will automatically collect the correct revenue for power consumed according to a variety of more or less complicated systems of tariffs.



Smith "Du-slot" meter with coin mechanism removed, and (right) B.E.M. variable-tariff prepayment meter

The outstanding trend during the past twelve months seems to Venner Time Switches, Ltd., to have been towards consideration of multi-coin prepayment meters, a thorough exploration of which field has resulted in arrangements for such a meter to be put on the market by this company very shortly. The other reason for the lack of electrical development to which we have referred lies, we think, in the very advanced stage of electrical performance which has been reached, and the position in this respect is well summed up by Mr. G. Tilstone, of the English Electric Co., Ltd., who writes:—"Concurrently with the attainment of higher efficiency in the production and distribution costs the demand for greater accuracy in the metering of the energy at the point of consumption has resulted in the gradual development of meters of improved performance and life; thus from the point of view of initial characteristics and accurate running over long periods the watt-hour meter must be ranked as an electrical instrument of precision."

In referring to electrical developments we have in mind the meter element only, and this we hasten to explain for fear of being called to task, is on account of the influence which is being exercised on meter work by the development of the small synchronous motor. This influence, we feel, is at present nothing to what it will be, for not only is it proving the ideal medium for time-base metering, but it seems to overcome many of the objections of twenty or so years ago to the maximum demand indication of that time. And our mind goes back to those days when the supply engineer viewed his considerable stock of returned m.d. indicators with an air of resignation, considering that the system had served its purpose. Can we advance to the extent which enterprise and the superiority of electricity in the domestic field permit without taking closer stock of individual consumer's maximum demand?

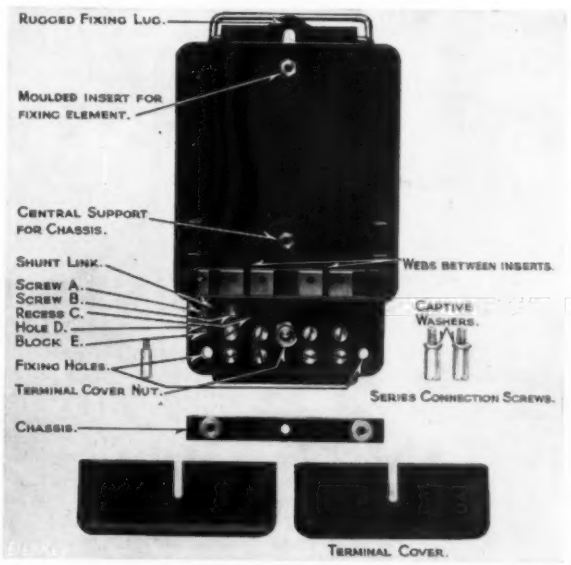
Messrs. Ferranti consider that the most notable feature of recent development is the rapidly extended use of self-starting synchronous motors which supply the constant speed drive necessary for the operation of the fixed charge collecting unit which forms part of this company's two-part tariff prepayment meter.

The first call for the additional revenue-collecting mechanism resulted in the appearance of some meters of peculiar shapes, and while it was a foregone conclusion that remedying this was only a question of time, it is a relief to many to find meters, complete with their "gadgets," with an external design which is, as Aron Electricity Meter, Ltd., puts it in referring to their new dual-coin a.c. prepayment meter, "symmetrical and not unpleasing." Messrs. Ferranti say that an important advantage of the "F.L." prepayment meters is that these modern improvements have been added without any considerable change in the bulk of the complete meter.

Many difficulties have been presented by lack of head-room with prepayment meters fixed in awkward positions close up to shelves or ceilings, and an Aron move to overcome this provides the coin slot at a level slightly lower than the top of the meter.

We find that within certain limits there is an increasing tendency to give more attention to the accessibility of components and less to reduction in overall size. Referring to their new prepayment meter British Electric Meters, Ltd., point out that particular attention was paid by the designers to making both the meter element and the mechanism as simple, robust and accessible as possible. In the Aron meter referred to the prepayment mechanism plug and socket electrical connector for the switch and the price change gear unit can all be removed from the meter without any fixing screws being detached. We learn of a new "Rex" meter, introduced by Messrs. Thompson & Co., in which the rotor can be taken out without removing the magnet.

We can see no material answer to the call of a year ago for a somewhat drastic reduction in the number of electrical sizes of meters produced, and 2½-A, 5-A, 10-A, 20-A, 40-A, and 50-A meters still fill the test boards. When one recalls the I.M.E.A. movement for standardisation in this respect and also the obvious advantages to the manufacturers, it is a little difficult to see the reason for this apparent lack of progress.

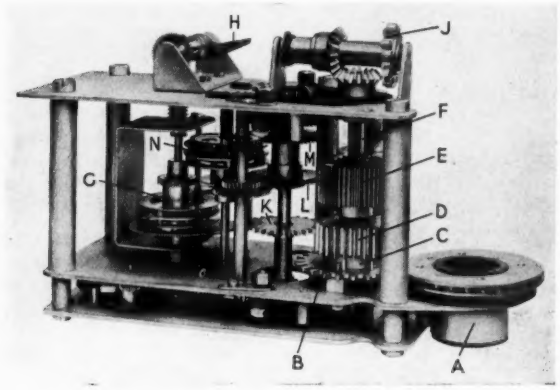


Base of the English Electric all-insulated meter

Again, the position is still obscure with regard to overload, and we still feel that the overload meter is an example of what happens when market conditions get ahead of existing B.S.S. requirements. Mr. Tilstone points out that by far the greater part of the life of the house-service meter is spent in metering a demand which is only a fraction of its full load

capacity. That seems to us another way of saying that the development of the electricity meter is bound up with an outlook which limits domestic electricity supply with regard to heating equipment to a supplementary or "convenience" usage only.

There are two opposing camps in the multi-coin prepayment-meter field which has of late been extended very considerably. One is for a single slot only and one is for a separate slot for each class of coin. Messrs. Smith Meters say: "We attach great importance to the provision of two slots, as we think that consumers have a psychological aversion to inserting a shilling in a slot which will take a penny; furthermore the two slots suggest to the consumer that the meter is an optional-coin meter, and encourage him to use it as such." They think that the single-coin meter will eventually disappear. British Electric Meters say that the two slots make for simplicity and reliability in operation. On the other hand we learn that the one slot of the Ferranti meter obviates errors due to the use of the wrong slot. A Ferranti development provides for three



E.A.C. dual-coin mechanism

A mounted on coin drum shaft, B linked to A, C D and E wheels on square shaft F, G and N differentials, H switch tripping lever, J driven by F, K engages with D, L transmission to differentials, M advances trip lever.

denominations of coins, which provision has been brought about by modifying the coin barrel mechanism.

We learn that the most important Sangamo development is that the "push in" method of operation which was necessary to caliper the coin, has been eliminated, the meter now being operated by a simple turn of the operating handle, which action automatically calipers and indexes the coin. This development, of course, refers to the company's three-coin meter introduced a few years ago.

Although the new prepayment meter introduced by Measurement, Ltd., is designed basically as a three-coin equipment, it can easily be made suitable to take two coins of any of the three denominations or a single coin. The dual-coin meter introduced by the Electrical Apparatus Co., Ltd., is made in two patterns, one for shillings and pennies, and the other for shillings and sixpences. A peep into the near future shows us a B.E.M. two-part tariff meter for shillings, sixpences, and pennies, with one slot. This all-insulated meter will be suitable for use as a "straight" prepayment meter or as a two-part tariff fixed-charge collector instrument, as the synchronous-motor unit is detachable. The company stresses this feature as highly desirable, in that it eliminates the necessity for substituting a complete meter where a consumer wishes to have a two-part tariff meter installed in place of an existing "straight" meter. A strong point is also made of explicit coin registration, and reading in £ s. d. is adopted so as to avoid confusion as to the amount of cash passed.

Considerable attention is being given to the provision for large credits, and two developments which serve to illustrate this point are the two-coin single-slot prepayment meter introduced by Messrs. Chamberlain & Hookham, Ltd., with its coin register, which will read up to £20 in £ s. d. and which affords a total credit of 10s. as ten shillings or 120 pennies, and the 99-kWh credit afforded by the E.A.C. meter.

Manufacturers have done much to overcome the difficulties which arise from the use of incorrect coins. For instance, referring to the dual-coin receiver as fitted to flat-rate prepayment meters, the Metropolitan-Vickers Electrical Co., Ltd., says that this is specially designed to be proof against jamming by bent coins or misuse, and is constructed with great accuracy. Though either a new or worn penny or shilling will operate it, a florin or a halfpenny will not do so. Any coin that will pass through the slot except pennies and shillings goes through the receiver and into the coin drawer without operating the mechanism when the knob is turned. In the C. & H. meter, "slip" in the handle prevents damage from attempts to force the handle when the wrong coin is inserted, and there is also a press-button release for coins of incorrect denomination.

There is also this easy-release feature on the E.A.C. meter, while a new feature of the Sangamo mechanism is its ability to handle any bent coin of correct diameter. But it will not operate with wrong denomination coins for which a press-button release is provided. The operating handle automatically returns to the insertion position when the mechanism is free from coins.

The controversy on "universal" variable tariff mechanism and change-gear compounds for price per unit changing still exists, although there have been a few modifications to certain of the equipments of both classes. In the new Measurement meter a small window at the top of the cover provides access to the price-change compound so that the supply authority can change the price on site without removing the cover. The compound is removed by loosening the knurled nut when an automatic braking device immediately prevents the running down of the mechanism.

The C. & H. price-change gear unit can be changed quickly and without tools by an unskilled person. It slips into position and is automatically engaged with the counting train and also with the differential gear. On the E.A.C. meter there is a change-rate device which is variable in very small steps simply by turning a screw which is accessible through a normally sealed opening in the cover. British Electric Meters say that theirs is the only universal price-change meter in which the price-change plate does not come away from the meter. This they claim precludes all possibility of damaging the plate when changing the price. They also stress that, as there is no need to disconnect the prepayment mechanism from the meter element, re-meshing of teeth is eliminated.

The Measurement single-tariff prepayment meter can be supplied with a step-rate unit or subsequently converted into a step-rate meter by the addition of the unit. Further, it can be converted easily into a two-part tariff meter by the addition of a fixed charge collector with a synchronous drive. The fixed charge is variable in halfpenny steps between 1d. and £1. This meter, by the way, is supplied with either an a.c. or a d.c. element, which are interchangeable, and conversion from d.c. to a.c. is simply and quickly effected by changing the elements.

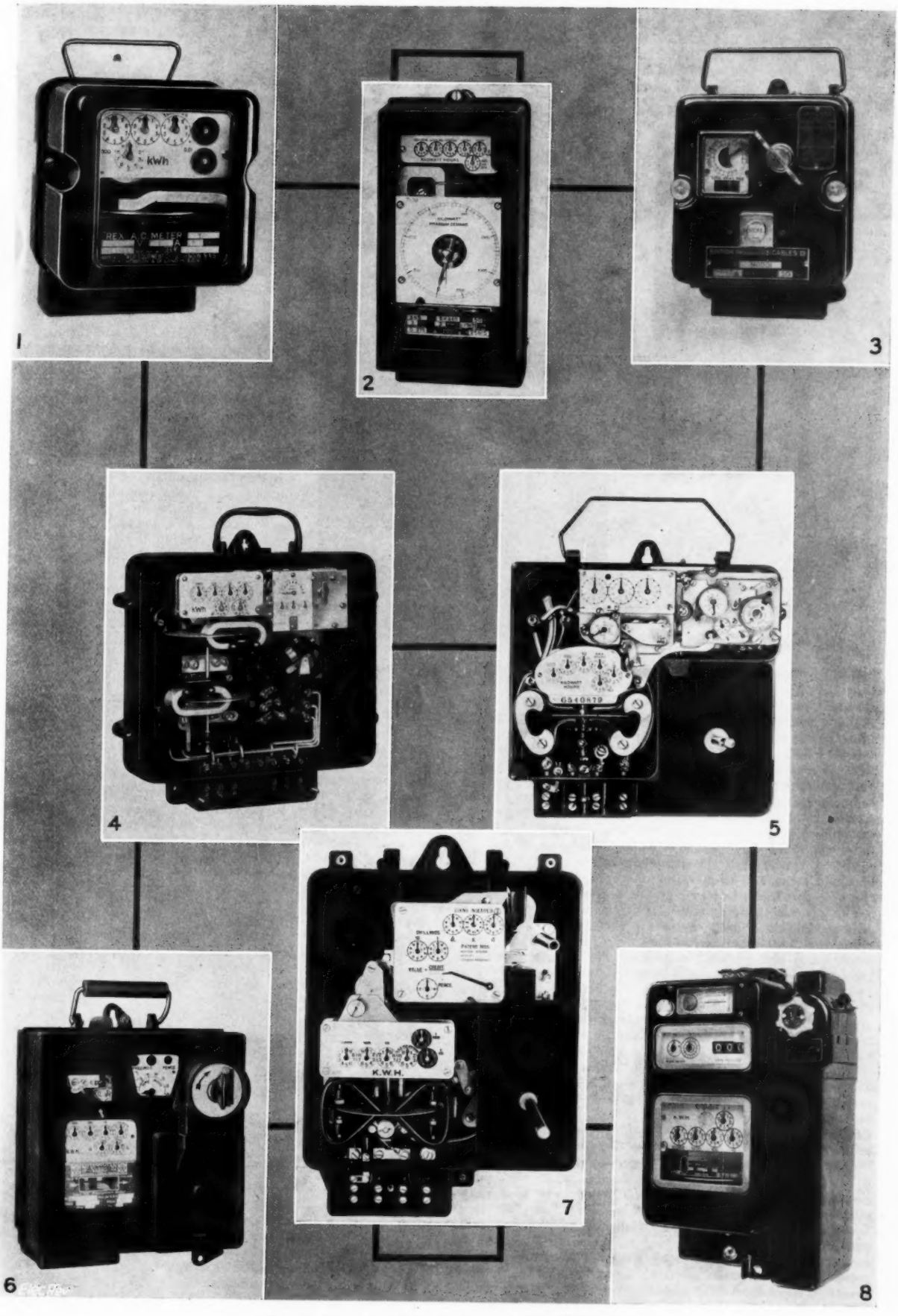
Dual Tariff Meters

Evidently the adoption of both lighting and heating in one household does not yet mean the automatic introduction of the two-part tariff, for we hear from Messrs. Robert Hornby & Co., Ltd., of a dual-tariff meter for such consumers. It has two meter elements—one for lighting and one for power—which are compounded through the differential. The lighting elements winds back the coin mechanism at a pre-determined rate, and the power element winds it back at a lower rate. If both elements are on at one time the power unit subtracts from the differential. In this way the irksome question of the consumer being unable to get light when he is in credit on the power side is overcome.

A further development of this idea is the Siemens-Schuckert load-rate meter, which is designed to serve for both lighting and heating tariffs in premises not wired separately. A power element is provided with a torsion head which is readily adjustable over a wide load range and which comes into operation when the load exceeds, say, 400 W. Up to that figure the lighting element only operates. It looks as though this will supersede the relay-operated load-rate meter of the same make, for the company thinks that the relay is not so reliable as the meter element, and also that it would probably "hunt" at about the change-over load. We learn of an improvement to the Met.-Vick. load-rate meter by the fitting of a new change-over device and a dual-coin mechanism. This meter encourages the use of electrical appliances suitable for connection to the lighting circuit.

And now we come to those meters which operate on a time basis only and which owe their development largely to the synchronous motor. There is the rent collector introduced by British Insulated Cables, Ltd., which provides for the collection of hire-purchase and fixed charges in definite sums per week, and cuts off the supply in the case of non-payment until the arrears are made up. This instrument is installed separately from the ordinary meter, so that it can be removed when hire-purchase payments are completed. To meet a claim over the composite collector in which the unit charge increases, the company says that this type of collector gives a false impression to the consumer in that in low-consumption quarters the price per unit is necessarily high to permit the recovery of the rent.

An important Sangamo development relates to the method of setting the collector. A resetting knob has been introduced; when this is rotated by an inserted screwdriver it



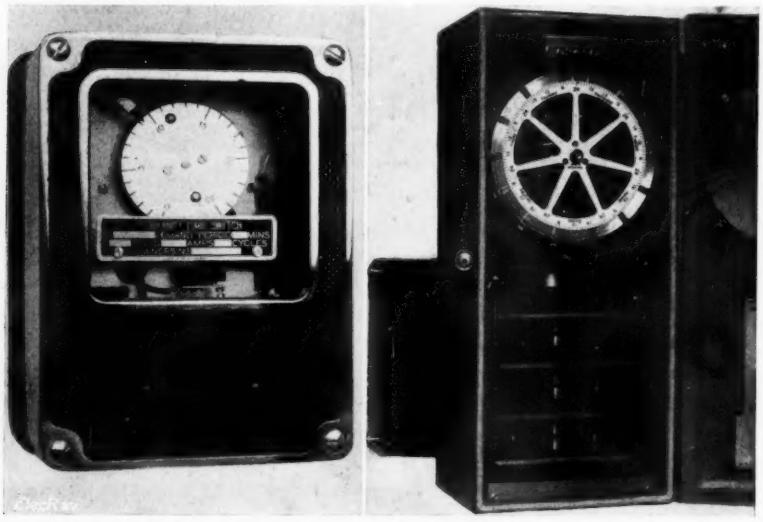
Examples of Modern Electricity Meters

1. The "Rex" lugless bakelite meter. 2. An Aron polyphase meter with maximum-demand indicator. 3. The B.I. rent collector. 4. The C. & H. polyphase prepayment meter. 5. Sangamo multi-coin apparatus with variable fixed-rate collector. 6. An M.V. load-rate prepayment meter. 7. A.c. multi-coin prepayment unit (Measurement, Ltd.). 8. Ferranti two-part tariff prepayment meter

operates a shillings-per-week dial. In this way the possibility of shock is eliminated. Another synchronous drive unit is the M.V. two-load fixed charge collector designed for use with two-heat fires in hotel bedrooms. If both fire bars are switched on an electromagnetic change-gear device in the collector comes into operation and permits the fire to be on for only half as many hours per coin.

A small motor " assisted drive " in the new Aron maximum-demand indicator permits the use of a reliable frictional restraint of the pointer to prevent shift under vibration or mechanical shock; the use for unusually short periods; and the expansion of the scale so that, if required for temporary loading conditions, the full scale marking can be made only a half or perhaps a smaller fraction of the rated full load of the integrating meter itself.

Most manufacturers report an increasing demand for bakelite-cased meters, and the recent installation of moulding plant in the Smith Meters works which will permit delivery of the all-insulated meter early this year is an indication of the general trend. But all makers are not for it. Messrs. Venner consider it of debatable value and say that quite apart from the manufacturing suitability of insulating materials for prepayment meter cases it still seems to them that if it is not possible to obtain a good enough earth for a metal meter case, then the provision of the insulated case in no way answers the question of how portable domestic apparatus can be earthed. The English Electric meter is now available in all-insulated form, and the terminal block is moulded solid with the base to afford great strength to the unit as a whole. It is also stressed that this precludes the possibility of ingress of dust and moisture at the block and base fitting.



Ferranti time switch for m.d. indicators, and (right) Nathan & Allen weekly dial programme switch

Some of the criticisms we heard a year ago have been answered by strengthening measures. For instance, the bakelite case produced by the E.A.C. has an external metal frame by which the meter is fixed; this takes the carrying strain and thus prevents distortion. The outstanding feature of the Ferranti bakelite covered meter is that, in addition to all the good protective features of its type, it retains the cast-iron meter back which, it is claimed, renders it far more robust and rigid than meters which have bakelite case backs. There is also a " Rex " (Messrs. Thompson & Co.) bakelite meter, a feature of which is the absence of any projecting lugs. The fixing screws at the sides and through the base of the meter are accessible with a screwdriver by way of deep grooves in the side of the case.

Judging from a C. & H. statement, however, the bakelite case is not necessarily a complete answer to a call for " shock-proofness," for they refer to all the metal parts fixed to the outside of the case being efficiently screened so that there is no possibility of shock due to accidental contact with a live part inside. They stress the importance of this because the consumer definitely *must* touch the case of a prepayment meter. Referring to the bakelite internal barrel which receives the coin, Aron Electricity Meter says that this is so arranged that in combination with the all-insulated meter cover and coin handle it prevents any risk of shock to the consumer. The Sangamo bakelite coin barrel is turned through a 360 deg. cycle, so preventing the insertion of instruments or coins attached to string or wire. Upon the insertion of a coin an insulated guard is thrown across the coin slot, and this is locked in position until the cycle is completed. The C. & H. three-phase prepayment meter is still the only one for that system that we have seen, but we have not yet come across the three-phase cooker for it to serve. Its standard prepayment mechanism is modified by the addition of two s.p. switches. Thus the circuit can be opened on all three phases and the meter can be supplied for use on three-wire or four-wire systems. It has been found to be very useful in connection with small motors.

A few modifications and improvements relate to the prepayment mechanism switches. The E.A.C. switch is of the contactor type and has a rolling action which provides protection against the ill-effects of very frequent breaking and making. A Sangamo modification lies in the mechanism to prepare the switch to make contact. A rapid " make " is now achieved by an upward movement of levers under spring tension. Extreme simplicity in operation is claimed for the B.E.M. switch which is of the single-break pattern with extra heavy current carrying contacts and only one spring for the whole action. Criticisms as to differential " fling " beyond the dial plate setting when the coin is inserted and the handle turned very sharply have been answered by a locking device by B.E.M.

We have heard very little about corrosion troubles, but the E.A.C. refers to the elimination of the very serious trouble and expense to supply authorities in dealing with corrision in service by special treatment of all iron and steel parts.

Rough testing on site at least is becoming more and more essential both from the points of view of the undertaking and of the consumer, and demands in this connection have led to the introduction of terminal test blocks designed to enable connection to be made to sub-standard testing meters without disconnecting the supply. Such a test terminal block introduced by Messrs. Landis & Gyr, Ltd., has a bakelite base with moulded-in metal inserts. For each current circuit there are three terminal inserts, each with an entry at the top and the bottom of the block. A link bar insulated from the terminal inserts is moulded in and is fixed in the centre of the block across each set of three inserts. These can be connected to the link bar by three cheese-headed screws which establish connection. The two lower left-hand terminals are normally connected to the appropriate current transformers and the two top outer terminals to the current coil of the meter under test. The current coil of the portable rotating sub-standard meter is connected to the upper middle and lower right-hand ter minals.

Normally when the meter is in service the right-hand and middle cheese-headed screws on the link bar are screwed home, and when making a test it is only necessary to unscrew these to put the current coil of the test meter into circuit. For each potential circuit inserts are provided at the top and bottom of the block, and these are connected by means of a link and are separated from the current connections by creepage barriers. For all external connections there are two pinching screws, while to protect all incoming and outgoing cables a pressed metal cover which may be sealed is provided. A useful rough testing on site measure is the provision round the rotor of the new " Rex " meter of a scale with divisions measuring 1/10th of the circumference of the disc.

Time Switch Developments

There is a close association between meters and time switches in connection with maximum demand indicating, and here, again, we must refer to the influence of the synchronous motor. A time switch introduced by Ferranti's is specially designed for tripping m.d. indicators of the Merz pattern at such intervals as 15, 20 and 30 minutes. Only one interval can be provided on the time switch at any one time, alterations to the gearing being necessary to change over. The contacts close for a period of 5 seconds and are capable of breaking 1 A at 230 V, 50 cycles. The synchronous-motor drive can be arranged for 110 V or 230 V. Standard meter, projecting switchboard and weatherproof cases are available for this equipment. A modification of this time switch is incorporated in the company's impulse m.d. indictor, thus presenting the whole as one unit.

Probably the greatest employment of the time switch is still in connection with public lighting control as it has been for many years, and the broad trend of development as regards new fields seems to have been from street lighting to house lighting to heating and latterly to industrial process work.

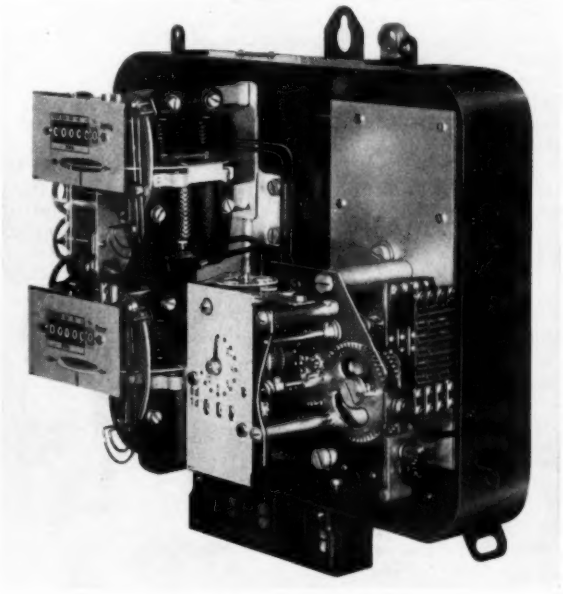
But we do not think that that represents the order of recent development in either commercial or technical importance because of influences which have been brought to bear on the design of equipment for the older fields, both within the manufacturers' limits and by external developments within the fields of application.

Generally, however, as Messrs. Nathan & Allen, Ltd., point out, the general trend of the electrical industry towards automatic control is resulting in a very much greater use of the time switch. It is certainly encouraging to learn from this company that it is experiencing an increase in the desire on the part of customers for quality with low maintenance cost. They say that the advent of the synchronous drive is resulting in the demand for hand-wound equipment becoming less and less, and that such hand-wound equipment is now generally bought on price only. But they also tell us that there are prospects of the synchronous-drive equipment becoming available at lower cost than hand-wound apparatus. Because, however, electricity supply conditions place a limit on the use of the synchronous drive, it does not seem likely that the hand-wound equipment will be ousted. About 70 per cent. of Messrs. Sauter's turnover represents standard electrically wound apparatus and the remainder is made up of hand-wound and special equipment.

The Horstmann Gear Co., Ltd., reports considerable orders for a.c. electrically wound time switches with either hand setting or solar compensating dials, and also with five days' reserve run which automatically comes into operation in the event of supply failure. This safeguarding also seems to ensure a useful extended life for the clock-type equipment.

However, in confirmation of the opinion that the synchronous drive must influence the future development of wound equipment, Messrs. Venner say that 1935 saw the further application of the synchronous motor as an alternative to the hand-wound or electrically wound clock, and that the enthusiasm with which the company's latest type of synchronous-drive equipment with thirty-six hours' spring storage has been received would make it appear that the provision of a spring storage has overcome the only possible objection to an otherwise obviously excellent form of drive.

We have often been asked if the supply engineer realises the importance of the time switch as a contributor to better load factor. We are not prepared to discuss here the relative merits of the various possible methods of improving load factor, but certainly much can be done by the aid of time control as distinct from other forms of automatic control. The idea of night heating is usually presented by such a discussion as this, and it was therefore with keen interest that we listened to Mr. Brooks when he expounded the possibilities of direct time control permitted by a recent Hornby development designed for use with everyday domestic equipment. It is, we should imagine, a time switch in its simplest possible

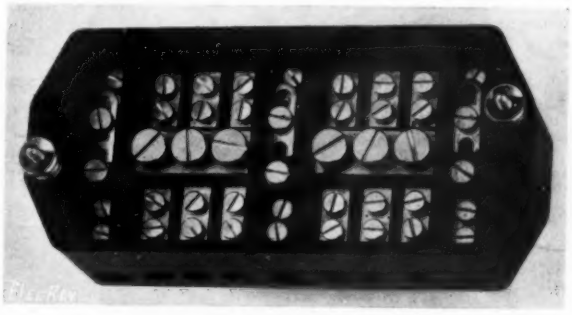


Hornby dual-rate equipment

form compatible with reliability. It is designed specially for use with the recently introduced air-cooled non-compression type domestic refrigerator, and an essential governing feature of the design is very low cost. It is also very small and consists of a synchronous motor geared down to a disc with three switch notches.

The refrigerators operate without thermostat control and are on circuit for a 1¼-hour period every eight hours, with 6¾ hours' off-circuit intervals. Because then, the actual time of the day when the refrigerators are on circuit is immaterial to their operation, here is a splendid opportunity for the supply man to choose settings to suit his own load curve. And as the loading of each refrigerator is 4¼ kW, we commend the idea to the serious attention of the load builder. The consumer has no control over the time switch operation.

We learn from Messrs. Everett, Edgcumbe & Co., Ltd., that the recent boom in dwelling flats has led to a demand for special switching for corridor and passage lighting. Time switches produced by the company for this purpose are usually arranged to close circuit at times varying with sunset and to switch off at a fixed time during the night, but in certain cases the switch is arranged to put all the lights on shortly



Landis & Gyr test terminal block

before sunset and to switch out a portion of them at some fixed time about midnight, leaving certain pilot lights to be switched off at dawn. This last operation also varies automatically with the season of the year.

Few manufacturers have talked about street lighting control, but it is a safe assumption that this is not on account of lack of commercial importance, but rather because of the inevitable measure of standardisation which has been brought about by constant demand over considerable time. However, such developments as the synchronous motor and solar compensating dials are keeping this type of equipment on the move. A 10-A time switch introduced by Messrs. Ferranti is designed for street, shop or similar lighting for which automatic switching on and off during a 24-hour cycle is required with adjustable closing and opening times. The contacts are capable of breaking 10 A at 230 V, and the synchronous-motor drive is available for 110 V and 250 V, 50 cycles. This instrument is supplied in a weatherproof case or suitably arranged for plug-in pole mounting.

In the latter type the mechanism can be removed without disconnecting the case or the terminal connections. Additional attachments to this time switch include devices which enable the switch to be left open or closed during any day or days of the week; permit advancing of the closing or opening times during any day or days; and also provide for late closing or opening during any day or days. There is also a solar dial which enables the times of closing and opening to vary with the times of sunset and sunrise.

Messrs. Horstmann report an increased demand for self-starting synchronous-motor driven time switches with solar compensating dials, and they say also that their time switches with 40- to 42-day hand-wound clocks with solar compensating dials are still in considerable demand. A new model introduced by this company is designed specially for use with public lighting by electric discharge lamps. It has air-break metal-contact type switchgear, with an adequate safety factor to permit dealing with the higher initial currents of such lamps.

Developments towards industrial process control are comparatively slow, but the possible field for exploration is immense. Ferranti, Ltd., draw attention to special time delay switches designed to open or close circuit after short periods, and generally to repeat the operation several times a day. Everett Edgcumbe say that their chief developments of late have been in connection with process timers, and that they are constantly finding new applications in the industrial world. The principle of these process switches is to start when the process commences and either to give an alarm in the case of manually operated plant or to trip out the circuit-breakers in the case of electrically operated equipment. The manipulation of these switches is very simple, it being only necessary to set the shorter of the two pointers on the dial to a position representing the duration of the process.

In some processes a series of operations is necessary and switches can be arranged to control the various stages of an industrial process involving the use of such equipment as

heaters, fans and motor-driven presses. In connection with a refrigeration plant a recent problem was to provide suitable control to permit defrosting of the refrigerator daily at a certain time, and during the defrosting period to permit the switching on of a fan with a predetermined lapse of time between switching off of the refrigerator pump and starting up the fan. This problem was solved in a comparatively simple manner by a "Synclock" process timer which has operated satisfactorily for some months without attention to the plant. Another development field found by this company is in connection with the silencing of the striking of public clocks at night. The striking gear is electrically operated and it is a simple matter to cut out the operating motor during the "silent" hours. The clock proper, of course, functions in the usual way when the striking mechanism is put out of action by the operation of the time switch.

A Sauter electrically wound programme switch is fitted with a 6-in. weekly dial which is arranged to take one week to rotate and is divided into seven daily sections. It makes it possible to have a different switching programme for each day, an ideal arrangement for central heating control, for heat can be switched on at different times each day, and switching operations omitted on any day. Each section of the dial can be fitted with up to six "on" and six "off" arms.

A "Synclock" process timer

Conversion to Public Supply. By F. Morgan, A.M.I.E.E.

How to overcome objections to scrapping private plant

A GREAT deal has been written of the successful electrification of works in this country, power being supplied either by public undertakings or by means of modern private generating plant. Engineers dealing with power sales know, however, that there are a number of works which retain inefficient power plant in spite of the advantages which would be gained by taking a public supply of electricity. Does the fault lie in poor salesmanship or in root causes which call for change?

Such works may be classified as (a) those taking part public supply only, and (b) those taking no public supply. In class (a) are those works which are putting all new extensions on to the public mains and changing over existing plant at a satisfactory rate. Others, however, lacking perhaps experience and sound advice, have put down new plant having a low power factor and, in addition, have relieved overloads on their private generating plants by placing, say, a large lighting load with a low load factor on the public mains. Where a two-part tariff is in force, involving a kVA charge, the resulting cost per kWh may be extremely discouraging. When the officials of such works have little real knowledge of electricity it is very difficult to convince them that complete change-over will result in a considerably lower cost, due to power-factor correction and to improved load factor. In addition, there is often a rooted objection to a ruthless scrapping of generating plant, which may be in first-class condition.

Class (b) can roughly be sub-divided into (1) those who have not been convinced that a public supply will effect a saving over existing power arrangements, and (2) those who do realise that a public supply would improve efficiency and lower costs, but who cannot find the necessary funds to finance the change-over.

Two Obstacles

In case (1) salesmanship may be at fault, but it is quite possible that in certain cases change-over from private plant will not be justified, at any rate, until such time as capital charges on existing generating plant are paid off. Again, the objection is raised to the scrapping of reasonably efficient plant, although it is probably agreed that if this plant did not exist and the problem were that of deciding upon an entirely new scheme, public supply would definitely be superior, giving higher efficiencies and lower costs compared with the installation of private generating plant. It would seem that the two great obstacles to change-over to public mains are the scrapping of plant and the capital cost.

Dealing with these objections: if the power user could make use of his existing plant in order to lower the cost of the public supply he would be much more likely to face the change-over costs involved. Since the Central Electricity Board has taken over bulk supplies of electricity there has been a fundamental change in the type of load required by an undertaking. To those taking a supply on the standard grid tariff the Board makes a maximum-demand charge during certain winter months only: for the remainder of the year the maximum demand on the system of an undertaking is limited only by the capacity of the transmission system itself. The higher the load factor of the country as a whole the lower will be the cost per kWh, and the Board therefore encourages unlimited use of supplies during off-peak months.

Few undertakings, however, pass on this advantage to their own consumers, although in some cases a special off-peak tariff is offered whereby the supply is cut off during certain hours of the day in the winter, and the kVA charge is reduced. Advantage is rarely taken of this concession, primarily because consumers must have power during the critical hours.

The tariff which has the approval of many of the undertakings of the country is a two-part tariff involving a kVA charge. This charge, which automatically applies power-factor adjustment, is made monthly and takes the form of, say, x shillings per kVA of the maximum average load measured during successive thirty-minute periods; the demand charged for is the highest during the last twelve months.

Let us suppose that the calculated payment is x shillings per kVA of maximum demand during each winter month (when the grid tariff maximum demand charge is in operation) and $x/2$ shillings per kVA for the remaining months of the year, the kVA charge in any month being the highest calculated payment (not the highest maximum demand) during the preceding twelve months. The effect of such a tariff would be to enable consumers to increase their maximum demand in off-peak months up to double that of the winter months without incurring any additional kVA charge.

A Use for Private Plant

The private plant owner, on changing over, would be able to take a full public supply during the summer, putting all extensions on the mains, and would utilise his existing power plant during the winter to keep down his maximum demand to approximately half that of the summer. His power bill would be considerably reduced by means of the plant which, under existing conditions, becomes merely scrap on changing over to public supply.

It would doubtless be found, moreover, that this consumer would quickly appreciate the advantages of a reliable and unlimited public supply, and would realise that savings in total costs achieved by running the private plant were problematical. In practice, total shut-down of this plant would probably take place in the course of a very few years. The public supply undertakings, however, would have sold many thousands of units, in respect of which they would obtain *at least* their normal payment for the maximum demand registered during the period when they themselves pay maximum demand charges to the Central Electricity Board.

This tariff should be standard and offered to all large power consumers without any discrimination, but existing consumers would find that further expenditure on new private plant could not be justified by the savings in reduced kVA charges. Moreover, there would be very little loss of revenue from existing consumers, as there is only a small proportion having normally a greater maximum demand in the summer than in the winter months. A further point to be noted is that standard metering equipment would remain unaffected by the change to this tariff.

There remains the problem of class B (2) where a works, perhaps recovering from recent bad trade, requires all the money at its disposal to cope with the materials necessary for orders which are now being obtained with improving trade. Here the remedy is hire purchase, with more liberal conditions than are at present imposed in the unlikely event of the undertaking being prepared to consider hire-purchase.

In general a more elastic financial outlook on the part of undertakings would enable many works to change over. While there will always be cases where it is unwise to risk money, in only a small percentage of the schemes approved would financial loss be incurred. On the other hand, the "lame dog" helped over the stile would generally prove a source of revenue for many years to come.

Instrument Manufacture

Recent achievements typified at the Physical Society's Exhibition

The twenty-sixth exhibition of scientific instruments and apparatus, arranged yearly by the Physical Society, is being held from January 7th to 9th at the Imperial College of Science and Technology. Leading manufacturers are to be represented in the Trade Section, while the Research Section will include a special sub-section devoted to experiments of educational interest, in addition to work submitted by apprentices and learners for the craftsmanship and draughtsmanship competition. Evening discourses are to be delivered by Mr. R. A. Bull on "Some Instruments Used in Recording Sound on Film" and by Mr. R. W. Paul on "Electrical Measurements before 1886." Selected electrical and allied exhibits are referred to in the following pages.

Automatic Coil Winder and Electrical Equipment Co., Ltd.

The "Douglas 1935" fully automatic multi coil-winder has a paper inserter and provision for final parting-off on completion. The speed is variable from 500 to 3,000 r.p.m. and wire of from 0.002 to 0.013 in. in diameter may be wound into coils of from 0.5 to 6 in. in length and from ⅛ to 4½ in. in diameter. Besides "Avometer" testing instruments there are a new "Avo" oscillator and a modulated radio signal generator.

Baird and Tatlock (London), Ltd.

A Gerber machine is fitted with a new type of flexible suspension, the centrifuge being directly mounted on a vertical motor; the "I.C.I." gelatine clarity tester employing a photo-electric cell will also be exhibited.

Bakelite, Ltd.

Synthetic resin products, including moulding materials, varnishes and cements; laminated rod, tube and sheets; and samples of manufactured articles.

Baldwin Instrument Co.

Inductance bridges include valve oscillator patterns; also a vibration galvanometer, potentiometer, capacity and Wheatstone bridges, and a bridge for educational purposes.

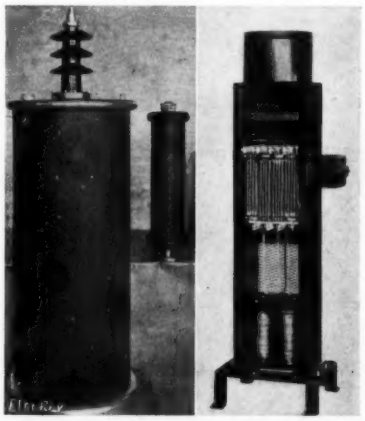
Bausch and Lomb Optical Co., Ltd.

Laboratory equipment includes an electric centrifugal specially designed for clinical work, constant temperature control apparatus with an electric heater adjustable from plus 5 deg. C to 40 deg. C., and an attachable colorimeter lamp with adjustable intensity.

British Electric Resistance Co., Ltd.

High-voltage resistances (illus.) developed this year for h.v. voltmeters, surge arrestors, X-ray work, etc., are of two patterns. The oil-filled type is supplied up to 200 kV, while the wire-wound type on porcelain formers with highly polished end-caps is made up to 400 W at a million volts.

Improved laboratory type resistances of various patterns, for bench and panel mounting, with patent self-lubricating copper graphite contacts, have slider boxes fitted with roller action for smooth control in sizes from 100 to 2,500 W. Non-inductively wound slider resistances, open and protected patterns, are fitted with overload protection for laboratory use, and a new range of back-of-board rotary type resistances is obtainable in capacities ranging from 4 to 300 W.



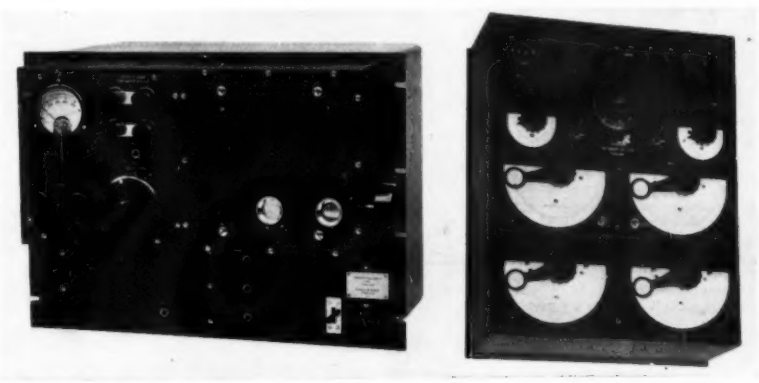
High - voltage oil - cooled resistances (British Electric Resistance Co., Ltd.) and (right) a Westinghouse metal rectifier

Potentiometers of commercial types between 4 and 1,250 W include a reversing type fitted with lead screw control for fine regulation. Portable Wheatstone bridges are fitted with self-contained galvanometer and completely enclosed selector switches.

A range of air-cooled shell-type transformers of open, shrouded and skeleton designs for commercial voltages and frequencies up to 2.5 kVA are suitable, among other applications, for rectifiers, transmitter filament supply, signalling circuits and general laboratory use. Open and shrouded representative designs of iron-cored chokes include types with a fixed inductance suitable for use in radio transmitter smoothing circuits.

Cambridge Instrument Co., Ltd.

A capacity limit bridge (illus.), designed for the rapid routine testing of electrical condensers, is a new product.



Muirhead type 3A capacity measuring set and Cambridge capacity limit bridge

To obviate the necessity for measuring the capacity of each condenser accurately the bridge has alternative arms set to high-limit and low-limit values, each being connected in turn by means of tapping keys marked "maximum" and "minimum." If the capacity of the condenser under test is within the set limits, the deflections of the d.c. type indicator (which is connected to the a.c. bridge by means of a rectifier circuit) will be to alternate sides of the centre zero, otherwise both deflections will be to the same side. A new short period galvanometer of the moving-coil strained suspension type does not require accurate levelling and has a high factor of merit (approximately 3,300). The coil resistance may be either 460 ohms or 35 ohms.

Colorimetric comparisons can be made to a high degree of accuracy with a densitometer, which embodies a device for providing a constant source of illumination photoelectrically, the photo cell current produced by the illumination from the projection lamp operating a galvanometer movement carrying a shutter which can vary the aperture. This steady light is projected through the liquids which it is desired to compare, and falls on a second photocell connected to an indicating instrument. Red and green filters are provided and the sensitivity of the galvanometer movements are adjusted for each by means of a switch.

A Cambridge portable multi-element cathode-ray oscillograph for recording on rotating film (giving 6 to 12 simultaneous records) is exhibited on the stand of the British Electrical and Allied Industries Research Association. It embodies several novel and important features, and has been designed primarily for use in a field investigation which is being carried out on transients induced in electric networks and equipment by switching operations.

A capacity meter for comparing the condenser under test with a calibrated standard impedance employs a rectifier bridge network and a d.c. pointer galvanometer for balance detection; the value is read directly on a scale approximately 300 mm. long. A universal bridge is entirely self-contained and includes a pointer galvanometer for d.c. measurements, and a sensitive single earpiece telephone for a.c. balance detection; an 8-V battery is used for d.c. measurements and also to operate a 1,000-cycle screened microphone hummer for a.c. work.

Dynamometer instruments are made to B.S.I. sub-standard accuracy, and employ a magnetic circuit of high-grade nickel iron; the movements are self-screened and are practically unaffected by external fields. A direct reading cable-fault localiser of new design utilises the principle of the Murray loop test, but the usual slide wire is replaced by two dials, including a sensitive galvanometer. The setting of the dials indicates the distance to the position of the earth fault, as a percentage of the length of the section under test. An accuracy of 1 part in 1,000 is obtainable.

R. M. Catterson-Smith

A new test pot for the calibration of industrial mercury-in-steel thermometers has a welded steel rectangular section tank fitted with adjustable partition and stainless steel draining flange within an embedded heater consisting of main and regulating windings, self-contained and connected to a special regulator, permitting thermostatic control at each regulator point. A small crucible furnace for a working temperature of 500° C. (maximum 950° C.) has apertures cut into the heater, so that, by glazing the casing with "Pyrex" glass, the work can be kept under observation during heating. A cylindrical furnace, split vertically in two sections for clamping round the work to be heated is designed for a maximum temperature of 550° C., and is finished in polished "Staybrite" steel.

A load resistance for technical colleges consists of a 4.4-kW 110-220-V transportable resistance suitable for students' use when investigating the external characteristics of d.c. machines. Banks of three units are employed for three-phase loads on alternators and transformers. A nine-section regulator of special design and a change-over switch permit a wide range of uniform loading steps for low-voltage machines or nine loading steps for higher voltage machines. A permanent section prevents the desired maximum load being exceeded.

Other items include surface and embedded heaters, the latter taking the form of flat and tubular sections, as well as moulded insulation and refractory sections as used in furnaces.

E. K. Cole, Ltd.

A mains-operated precision standard signal generator, enabling sensitivity, selectivity and fidelity determinations to be carried out on all types of radio re-

ceivers, has a wide carrier frequency range (80 kc—25 Mc), individual bands being selected by an integral coil mechanism; triple shielding gives low leakage even at 20 megacycles; and provision is made for the continuous variation of the output from 1 microvolt to 1 V.

A mains-operated low-frequency beat frequency oscillator is continuously variable from 10 to 12,000 cycles per second. The harmonic content is less than 1 per cent. over the greater part of the frequency range and the output voltage is within ±0.5 db from 50 to 12,000 c.p.s. A distortion factor meter is portable and an output meter of a rectifier type with adjustable impedance has a range of from 2 to 20,000 ohms for a voltage range of 0.1 to 200 V.

A self-contained mains-operated audio-frequency precision capacity bridge with visual null indicator has a direct reading loss correction control and a calibrated differential condenser with logarithmic scale shape for the accurate determination of small capacity differences. A self-contained mains-operated 1,000-cycle portable inductance bridge has a range of 10 microhenrys to 100 henrys; inductance and magnification are directly indicated, and measurements may be taken on iron-cored coils with superimposed d.c.

For field strength measurements and the recording of fading signals a superheterodyne receiver has an additional oscillator coupled to the second detector in order to heterodyne the intermediate frequency signals at about 1,500 c.p.s. The output at this frequency from the low frequency portion of the set is applied to a diode detector, the output load of which comprises the recording milliammeter.

An inexpensive portable noise-measuring meter comprises a special dynamic microphone, frequency weighting network, calibrated attenuator and high gain amplifier working into a rectifier type output meter calibrated directly in decibels above the normal threshold of hearing (0.0002 dyne per sq. cm.) at 1,000 c.p.s.

A. C. Cossor, Ltd.

Beside several types of portable oscillographs, there is an electronic engine indicator which responds to both steady and fluctuating components of pressure. A cathode-ray oscillograph is employed as a recorder, the outfit being suitable for any engine speed and all types of engines.

Crompton Parkinson, Ltd.

In this wide range of instruments the most interesting new development is a "Tong-Test" type of portable clip-on multi-range ammeter for automobile use. This instrument, with its additional components, enables the voltage of the battery to be measured and the current in lighting circuits from 3 to 15 A or from 6 to 60 A to be indicated. The current taken from the battery when starting up the engine can be measured without disturbing the electrical circuit. The standard equipment provides ammeters of 0-60 and 0-400 A, while by means of a simple expedient up to 800 A can be measured. The equipment consists of a "Tong-Test" instrument complete with an additional movement unit, and another unit to give the voltage and low current range.

J. H. Dallmeyer, Ltd.

The "Parvux" photo-electric illumination meter has a bakelite housing in a leather case measuring 2⅞ by 3⅜ by 1½ in. and weighing 10 oz. The dial is engraved in English foot-candles from 0 to 250, and a chart in the lid of the case shows the values recommended for various types of work and general lighting. The self-generating photo-electric cell, consisting of a thin film of selenium upon a sheet of metal, is, by cathodic dispersion, covered with an extremely thin coat of gold, which, for the purpose of conducting the current safely, is fitted at the edge with a metal ring. The light in the semi-conductor (selenium) will release photo electrons which will flow from the outside gold electrode through the measuring instrument. This arrangement represents a so-called barring layer photo cell in which the photo electrons released by the light penetrate a border layer between two conductors of unipolar conductivity independent from a vacuum or gas space.

Each meter is provided with a red press-stud, which is operated when the amount of light is insufficient to move the needle. A small white screw to adjust the needle to the zero position is fitted.

Darwins, Ltd.

Examples of permanent magnets and magnet steel for varied purposes, including new nickel-aluminium and nickel-aluminium-cobalt alloys with a coercive force of from 400 to 600. "D.C.I." alloy has an abnormally high magnetic saturation value and is used for electro-magnetic apparatus working at exceptionally high flux densities. There are also low-expansion alloys for thermostats and a range of heat-resisting alloy steels.

Ebonestos Insulators, Ltd.

A variety of mouldings having special application to the electrical and scientific instrument industry is made of "Ebonestos" plastic composition, bakelite, "Beetle" and other synthetic resins in white and selected colours, as well as a selection of mouldings made of what is known as resin "M."

Edison Swan Electric Co., Ltd.

A sealed-off high-vacuum cathode-ray tube with a 10-in. diameter fluorescent screen, giving a substantial black and white picture, has a sensitivity of 750 V mm. per volt, V being the second accelerator voltage (which is 3,500). The first accelerator voltage is 1,200±300; the shield bias for beam cut-off does not exceed 250 V and the shield bias for a beam current of 30 mA is between 100 and 120 V. Grid bias for modulation is approximately 20 V and the heater needs from 1.2 to 1.4 A at 2 V. Modifications have been made to high-voltage mercury vapour-filled rectifiers for use with cathode-ray equipment, of which there is now a portable type made to customers' own requirements.

The improved construction of grid-controlled gas-filled relays for use in time base and thyratron counting circuits provides a longer life and increased stability in operation. Some of the oxide-coated gas-discharge rectifiers for battery charging, cinema arcs, etc., incorporate a new cathode design giving a life of two years in most cases. Medium- and high-power transmitting valves for short-wave working include screen grid transmitters of 75 and 250 W dissipation, while lower power ultra-short-wave oscillator valves with graphite anodes dissipating 65, 100 and 250 W have a small anode and grid lead inductance, and the electrodes are so dimensioned that electron paths are as short as possible.

W. Edwards & Co.

A new model vacuum oven (illus.) designed for rapid evaporation under very low pressures has an electrically heated drying surface, which is maintained at any desired temperature up to 100° C. (or to order) by automatic regulation so as to avoid freezing of the material being treated. A large window at each end of the oven enables the material to be observed during the process, and a self-adjusting door ensures an airtight seal and is instantly opened and closed by one simple movement.

By means of simple interchangeable heads a universal glass-marking machine is made suitable for flange-making, stem making and sealing-in radio valves and electric lamps in laboratories where small numbers of experimental electrodes, lamps and valves are produced.

The rotary blower and Type IV vacuum pump can now be had with a cyclone separator fitted to the inlet for use as an aspirator for flue gases, etc., or wet and dry gases. Improved high-frequency eddy current heaters are now available with a silent variable output and considerably larger current in the heater coil. The latest apparatus for the "hot extraction" process of estimating gases in steel and other metals by vacuum fusion now employs either a carbon resistance furnace or high-frequency induction heating.

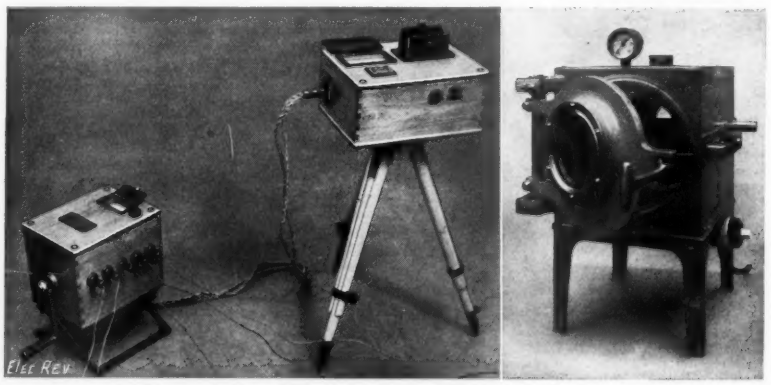
A finely adjustable sealed needle valve, vacuum gauges, more robust McLeod gauges, and a range of vacuum pumps are available.

Elliott Brothers (London), Ltd.

A recording power-factor meter of an entirely new design is of the iron-cored dynamometer pattern. It measures the ratio of the total watts of the circuit to the total wattless energy, and is scaled in cos ϕ or "power factor," reading 0.55 lead—unity—0.55 lag. The power consumption of the three-phase instrument is 32 VA per current circuit (5 A) and 15 VA for standard volt circuits. For the single-phase instruments the power consumption is 14 VA for the current coils and 12 W for 110 V pressure circuits.

Elliott portable combined CO_2 and temperature measuring apparatus for flue gases

The Elliott - Sangamo transmission system (Shotter patents) for remote integration is the latest development of the Elliott transmission system and similar to that employing the rotation of a coupling loop. The distinguishing feature is that the distant transmission and remote operation are performed without the use of contacts. The distant transmission of the readings has no effect on the accuracy of the meter or on its light-load running, nor does it impose any back torque on the meter element. Two pilot wires only are required between the transmitter and receiver, and their resistance may be several thousand ohms. The resistance of the pilot wires does not affect the accuracy of the readings.



Geophysical "Megger" earth tester (Evershed & Vignoles, Ltd.) and new model vacuum oven (W. Edwards & Co.)

Portable combined CO_2 and temperature measuring apparatus for flue gases (illus.) employs the Siemens principle of gas analysis, and is arranged in a compact portable form; it operates in conjunction with an electrical distance thermometer. A new CO_2 aspirator and modified form of transmitter are an improved form of the Siemens gas-analysis apparatus. A steam flow indicator operates on the mercury U-tube principle, and is used in conjunction with orifice plates. A float is carried on one limb of the U-tube, and its motion transmitted by means of a frictionless magnetic coupling to the indicating mechanism.

Ellison Insulations, Ltd.

Beside insulating varnish and cement and plastic compound, various parts made of "Tufnol" serve to show how this non-metallic material can easily be machined or moulded into any shape with accuracy.

Everett, Edgcumbe & Co., Ltd.

This company's electrical speed indicator scale is evenly divided and can be placed at any desired distance from the transmitter; there is no flexible shaft, a number of ranges can be provided, the change-over from one to the other being effected by throwing over a switch. A miniature a.c. generator is used (in place of the usual d.c. pattern) and a rectifier-operated moving-coil instrument forms the indicator. Thus there are no sliding or rubbing contacts whatever in the circuit, so that permanence and accuracy are ensured. The portable outfit is complete in a carrying case with disc attachment for the measurement of surface speeds.

The "industrial" pattern "Synclock" operated time interval meter recently introduced, in which one revolution of the larger pointer corresponds to 10 seconds and of the smaller to 5 minutes, accurately measures time intervals from 1-5th second up to 5 minutes. This model is fitted into a round case for wall or bench mounting. The corresponding "Precision" model for measurements from 1/20th second up to 10 seconds, with an accuracy of about 1/200th of a second, is fitted in a portable oak case.

Magnetic damping is now available for all Everett-Edgcumbe graphic instruments and a.c. recorder charts are all evenly divided throughout the entire range, an improvement on the cramped "square law" charts. An innovation is the introduction of a grapher of the "super-responsive" type, in which the torque has been so far increased and the weight of the movement reduced that fluctuations lasting less than 1/5th second are faithfully recorded. These instruments have been developed for the measurement among other things of the modulation current in radio transmission.

The "Radiolab" all-purpose tester embodies a rectifier-operated moving-coil instrument with a number of multipliers and shunts, all operated from a single switch knob. The Holophane-Edgcumbe street lighting photometer is believed to be the only deflectional type so far developed which is capable of measuring the limits of illumination met with in street lighting practice. An audio-frequency oscillator has a frequency range of 20-15,000 c.p.s., which is varied in well-defined steps. A constant impedance "T" network is fitted and the oscillator is constructed on the tuned circuit, as distinguished from the beat frequency, system.

Evershed & Vignoles, Ltd.

The latest "Megger," "Meg" and "Wee-Megger" testing sets include an instrument which enables both the continuity of the lead sheathing or tubing and the insulation resistance of an installation to be measured.

The Evershed-Midworth "Telemeter" is a recently developed system for indicating at a distance the level of water in reservoirs, or other quantities, which operates on the principle of controlling an a.c. so that the two components of the wave, above and below the zero line (positive and negative) which are normally symmetrical, may be made asymmetrical to any desired extent for the purpose of transmitting indications.

A new two-range "Meg" earth tester has a range of 0-500 ohms with switch to divide by 1 and 10. The geophysical "Megger" earth tester shown (p. 10) is a d.c. hand-driven generator having two reversing commutators with a main winding for supplying the testing current through the soil and a second winding developing a lower e.m.f. which, through an adjustable potentiometer, is made to produce a back e.m.f. equal and opposite to that existing between the potential electrodes in the soil.

Ferranti, Ltd.

Included in the range of small instruments are 2-in. dial moving coil types, both round and with square flange for flush mounting, fitted in black moulded cases with ranges from 250 mA up to 10A. Beside rectifier and thermal instruments of the same size the familiar 2½-in. dial instruments include testers.

Self-starting synchronous motors for 50 cycles run at 200 r.p.m.; starting is definite and can only take effect in one direction. The synchronous torque is 20 grm.-cm., but the consumption is only 1.4 W. A new hour meter records on a four-figure cyclometer train the total number of hours that a circuit has been in use. It consists of a self-starting synchronous motor operating the dials through suitable gearing. The dials read up to 9,999 hours, and then restart at zero. A pointer dial is also provided reading in divisions of five minutes.

A new maximum demand alarm relay (illus.) is operated by impulses from a pair of contacts fitted on a watthour meter or kVA hour meter in a similar manner to an impulse type maximum demand indicator. Resetting is performed by a synchronous timing element incorporated in the relay, and takes place every ten minutes. The two-point maximum demand indicator is a development of the ordinary 8-in. dial impulse type.

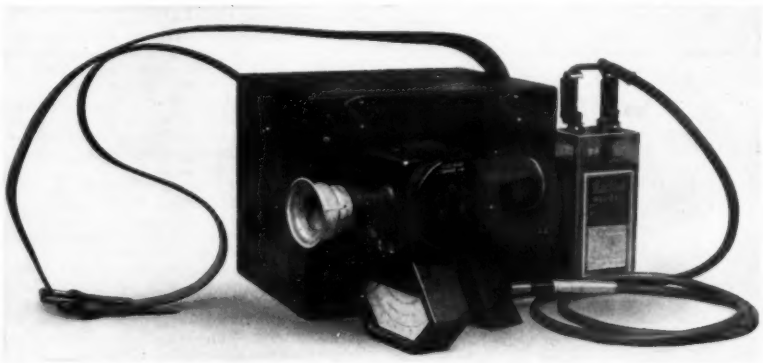
Ferranti maximum demand alarm relay

A two-part tariff prepayment meter makes use of the self-starting synchronous motor described above to operate the fixed charge portion of the meter. A differential system is operated in a positive direction on one side by coins inserted, and on the other side in a negative direction by the combined movement of the meter and fixed charge sections, the movement of the two sections being summed up by means of a "sun and planet" system. The amount of fixed charge to be collected per week is governed by altering the amount of travel of a quick start thread which is inserted between the synchronous motor and the second differential to give suitable increments of motion to the differential.

A light-sensitive counting device incorporates a sensitive moving-coil relay connected to a single light cell on which a beam of light is focused. A split core current transformer is designed to clamp round existing cables without disturbing the connections. The core is swivelled to open up to 180 deg., and the butt joints, which are exceptionally large, are self-aligning. Various other instruments of the miniature pattern as well as switchboard instruments, transformers and relays are also exhibited.

Foster Instrument Co., Ltd.

Among new instruments are an improved radiation pyrometer suitable for use in steelworks, and the "Flexipush" indicating automatic temperature controller for oil, gas and electrically heated furnaces. A new form of optical pyrometer (illus.) of the disappearing filament type is completely self-contained, the Wheatstone bridge, incandescent lamp, indicator and rheostat being contained in the main body of the telescope, while the battery is housed in the handle, and controlled by a trigger type switch. This model is offered as an alternative to the standard type, which is operated from a separate accumulator connected by a length of flexible cable and plug, the use of the separate accumulator being found inconvenient in some industries. Both the self-contained and standard models are available as single- or double-range instruments with various scalings covering temperatures from 700 deg. C. to 2,300 deg. C.



Optical pyrometer outfit (Foster Instrument Co., Ltd.)

A. Gallenkamp & Co., Ltd.

Electrically heated furnaces now have automatic thermostatic control gear which is much simpler and cheaper than previous patterns.

Electrically heated ovens with automatic thermostatic control to plus or minus 1 deg. C. over the full working range of 37-100 deg. C. or 50-300 deg. C. according to type are available in various patterns for drying, baking, etc., in laboratories. An electric oven for the determination of loss on heating of asphalts is of entirely new design, while an oven for the Ira Williams plastometer, approved by the Research Association of British Rubber Manufacturers for testing the plasticity of unvulcanised rubber stocks, can also be used on all types of materials having a similar consistency.

Davies' improved plug resistance boxes have contacts totally enclosed in bakelite mouldings, giving long life and exceptional freedom from inaccuracy due to dust and damp. Copper-constantan thermopiles of a new pattern with 250 junctions have a very sensitive action; special design has reduced lag so that steady readings are obtained very quickly. A straight line model with 70 junctions for spectroscopic work is also made. Dry metal rectifier units for laboratory use in place of accumulators can also be used for charging accumulators if required.

Gambrell Bros. & Co., Ltd.

A new type of galvanometer has a high factor of merit and a periodic time of about three seconds. The zero stability is of a very high order, the instrument being, therefore, very suitable for calibration, and it is not affected by level.

In an insulation testing equipment the deflection of the galvanometer by the leakage current is matched by a current

passing through a standard megohm, the insulation resistance being indicated on the dials which control the voltage necessary to give the required current through the standard megohm. There is no necessity to calibrate the galvanometer, the readings being obtained rapidly and accurately.

A portable potentiometer has a standard cell and reflecting galvanometer contained in the same case. Two ranges are fitted on the standard model 0-100 millivolts and 0-1 V.

Igranic Electric Co., Ltd.

Apart from push-button across-the-line contactor starters, there is the "Thermentor" electro-dynamic automatic heat regulator for domestic cookers, combined with a timing device. Also the "Lo-vo-lite" transformer-switch-fuse, master control push-buttons, miniature limit switches of the roller and travelling nut types, and automatic precision timing control gear.

George Kent, Ltd.

The "kM" recorders for measuring the flow of water, steam, air, gas, oil or any other fluid have recently been redesigned, and modifications have been

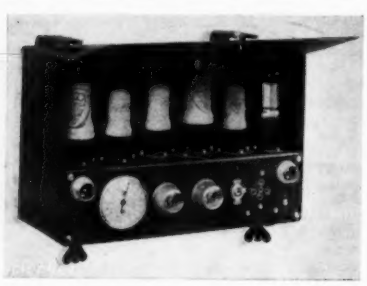
George Kent impact-type air-flow meter as supplied for the Mersey Tunnel

made which give a still greater reserve of power, increased accessibility and adaptability. Other advantages of particular importance are increased strength and reduction of weight due to the use of steel pressings, built-in mercury U-tube, and the use of stainless steel for all valves. All meters are adaptable for panel, wall, or post mounting. The pen arm is adaptable on site for right or left-hand charts, the enclosed clock unit is very easily removed, and the pre-calibrated pressure attachment is accessible from the front of the meter.

An up-to-date air operating pressure controller will be shown, together with a replica (illus.) of the specially designed impact plate type air flow meter as supplied for the measurement of ventilation air in the Mersey Tunnel. These meters are installed at sixteen different points in the ventilation shafts, and all records are transmitted electrically to recorders on a panel in the central control room. Another type of electrical transmitting air flow recorder is the R.T.E. or ring balanced type.

Marconi's Wireless Telegraph Co., Ltd.

Type RP.20 portable radio receiver (illus.) is designed specially for permanent installation in motor cars and



Marconi RP.20 car receiver

motor cycle combinations for reception, on either head 'phones or loud speaker, even when the vehicle is travelling at its maximum speed, of continuous wave, interrupted continuous wave, or telephone signals. Type AD.49/50 transmitting and receiving equipment is for use on the smaller types of aircraft where space is restricted.

Type DFg.10 direction finder is highly selective and easily manipulated. It can be supplied with a desk or without for mounting on a table, and provides for the circle, figure of eight, and cardioid polar diagrams of reception of continuous wave, interrupted continuous wave, and telephony signals in conjunction either with the Marconi-Adcock spaced aerial system or the Marconi-Bellini-Tosi loop aerial system.

Other items are an audio-frequency tone generator; an ultra-short-wave standard signal generator; a short-pulse transmitter for investigation of the ionosphere with the pulse frequency "locked" to the 50-cycle a.c. mains frequency; a portable pulse unit for aircraft direction finding; and a phase measuring unit for determining the relative angle of signal arrival.

Marconiphone Co., Ltd.

The main feature will be a comprehensive display of valves, special interest attaching to certain new types, among which are the A537, MH40 and ML40, triodes developed for the first stages of high gain audio frequency amplifiers, having steatite insulation and treated to reduce basic noise to the lowest possible level.

Another new type is the A577 valve voltmeter triode having a high input impedance and glass insulation suitable for use at frequencies up to 10 megacycles. The X41 is a new frequency changer of the triode-hexode type, capable of operation at frequencies up to 60 Mc, and also a useful source of modulated radio frequency for wavemeters and similar instruments. The DA.30 is a new 30-W power triode designed for use in a special class A-B circuit, giving an exceptionally high efficiency.

Other items are a loud speaker having an elliptical cone which gives a more concentrated distribution of sound in the horizontal plane; a new and exceedingly compact receiver for use on motor vehicles, with interesting features of electrical and mechanical design; a new universal superheterodyne receiver, and other instruments.

Mercury Switch Manufacturing Co., Ltd.

Mercury switches ranging in capacity from 1 to 50 A will include an improved change-over type, an improved magnetically operated vertical switch, and a power switch with a "step-up" in the glass which has the effect of considerably increasing the short-circuit value.

Metropolitan-Vickers Electrical Co., Ltd.

Beside typical examples of moving-iron, moving-coil, and dynamometer types of measuring instruments of the switchboard and portable patterns, there are such research outfits as a noise-measuring set, magnetic crack detectors, rotary vacuum pumps, &c. Also self-contained meter-testing equipment with a sloping desk front and mounted on rubber-tyred castors. A load-limiting relay consists of a thermal bi-metal strip enclosed in an evacuated glass tube and operated by an adjustable shunt in the load circuit, together with a "Sun-Vic" vacuum switch capable of breaking 10 A at 230 V without any arcing.

Multitone Electric Co., Ltd.

Aids for the deaf are combined with valve amplifiers and with a radio set; also a portable electrical stethoscope for deaf doctors and for loud-speaker demonstrations. The "Equalimeter" is an instrument for quantitatively examining a patient to determine minimum thresholds of hearing, enabling the patient and observer to receive approximately the same sensation from normal and amplified speech.

Muirhead & Co., Ltd.

Standard methods of winding giving extremely low reactance have been adopted for resistances of all values, which are now made up as fixed standards, as decade units and boxes, and as faders and gain controls in a variety of types. A new type of radio frequency attenuator has been checked at frequencies up to 5 megacycles per second and is calibrated directly in microvolts, the output voltage being read off a dial multiplied by a decimal factor determined by the position of a switch. Among condensers Model 27 is a fixed standard of a particularly stable type.

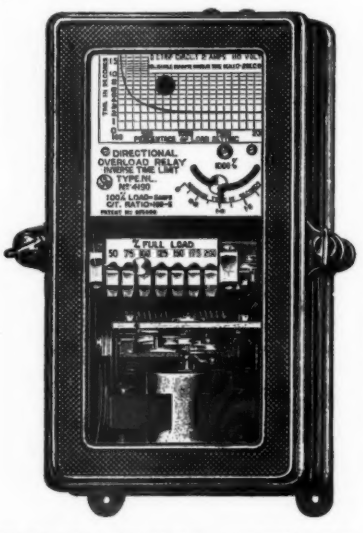
For an inductometer (type 19) having an extremely open linear scale over the range of 0—25μH, a helix of copper tube is employed with a contact arranged to slide round the inside, and actuated by a screw of the same pitch as the helix. A scale gives the angular position of the contact and a figure behind a window indicates the particular turn of the helix on which contact is being made. For the heterodyne capacity measuring set (illus. page 9) with which capacities of small condensers may be determined quickly and with a high degree of accuracy, no telephones need be used as all adjustments are made to a definite meter deflection; capacities up to 1100$\mu\mu$F may be measured with a discrimination of 0.03$\mu\mu$F.

An attempt has been made to produce a thermionic multi-range a.c. voltmeter with a scale shape approximating to that of an ordinary d.c. moving-coil instrument, and having at the same time an input impedance high enough to enable it to be inserted across most circuits without appreciably altering conditions.

Type 9A modulated radio frequency oscillator is a general purpose portable instrument covering a range of 40 kc to 10 Mc per second by means of plug-in coils. A low external field is obtained by copper lining the box and by mounting each coil in a copper screening can.

Nalder Bros. & Thompson, Ltd.

A recently developed maximum demand warning system consists essentially of measuring and contact-making apparatus at the control end and of visual signalling devices at the various load



Single-pole directional overload relay (Nalder Bros. & Thompson, Ltd.)

centres. The m.d. is summated, measured and recorded in kilowatts or kVA, as the case may be. The control is effected by m.d. time lag relays and auxiliary contactors. Each remote signalling unit comprises three coloured lights, analogous to those used for automatic street traffic control.

A new three-element induction type continuous chart recording kVA meter embodies a simple compensating device which renders the readings accurate over a very wide range of variation of power factor. Another development is the type NL directional over-current relay (illus.), consisting of two elements in one case, *viz.*, an over-current element having an inverse time limit with adjustable definite-minimum time characteristic, and a directional element which is instantaneous in operation and is independent of the line voltage down to 1 per cent. of the normal. This class of relay has been specially designed for the protection of ring mains and interconnected networks.

W. H. Pettifor

In a range of electrical aids for the deaf of various pitches and differing wave-form characteristics are electrical bone conductors and a test instrument that enables prescriptions to be made out for individual cases of deafness. There is also a universal voltage radiogramophone adapted for twenty bone or air conduction receivers for the instruction of deaf children.

Philips Industrial

Self-contained apparatus for X-ray crystal analysis by the Debye-Scherrer and Seemann-Bohlin methods comprises a metal case containing the transformer and cooling fan; two camera holders; two "line" focus shock-proof "Metalix" interchangeable tubes with anodes of copper or molybdenum (cobalt or tungsten can be fitted), and two cameras, each with two diaphragms. Specimens up to 1 in. in thickness can be examined, the h.v. transformer is surrounded by a jacket containing circulating water for cooling, and all external parts of the apparatus are earthed.

A "line" focus research tube for crystallographic work embodies complete protection against unwanted X-radiation.

A sodium lamp for analysis involving the use of polarised light to operate on d.c. mains is now available, while a rectifying valve with an exceptionally high rating up to 1,000 mA and 125 kV peak has an emission which is virtually independent of variations in filament supply. Beside photoelectric cells there are "barretters" (regulator lamps), so arranged that when the voltage applied to the filament increases within certain limits, the resistance increases at the same rate, and hence the current passing remains constant.

Hot-cathode relay tubes are gas-filled oxide cathode rectifiers with a third electrode which acts as a control grid; they pass current in one direction only, the third electrode controlling the rectified current within certain limits, *i.e.*, increasing the negative voltage applied to the auxiliary electrode increases the critical anode voltage which must be applied before anode current passes, thus enabling the tube to act either as a relay or as a current control.

Automatic rare gas fuses have two metal electrodes some little distance from each other in a sealed glass tube filled with rare gas which acts as a perfect insulator until a certain potential difference causes the gas to become ionised and a glow discharge causing the excess charge to be led to earth.

Salford Electrical Instruments, Ltd.

A range of miniature moving-coil instruments designed to the new "Service" specification has a movement that is entirely new and covers ranges from 1 mA upwards, with voltmeters of 200 or 1,000 ohms per volt. A similar movement, but with a cobalt steel magnet and suitable winding, has the low range of 25 microamperes for full scale.

New 6 in. portable moving-coil and moving-iron instruments of sub-standard or first-grade accuracy are housed in an oiled teak case with a removable lid and protected terminals. A multi-way voltmeter switch has contacts of improved design in which the rotary brush fingers scrape the fixed contacts so as to be self-cleaning; a strong click action ensures correct positioning. The "Elf" earth leakage trip for compliance with I.E.E. Regulations actuates a miniature circuit-breaker by a leakage coil operating with 30 mA, thus preventing a dangerous rise of potential above earth; a press key provides for testing the operation. A new air thermostat designed for maintaining constant temperature in rooms which are electrically heated has an all-insulated case and low resistance.

Beside a road surface brightness meter there is a new photo-electric exposure meter specially designed for ease of use, one movement of a dial being all that is required. The illumination meter range has now been extended by a high-range model of 250 foot-candles and a low-range model of 10 foot-candles, both double-pivoted instruments. There is a precision reflection meter for analysing the colour of flat samples of solid substances as paper, textiles, rubber, moulding compounds, and other similar substances. The company's electro-magnetic fatigue tester (illus.) has been completely redesigned for improved performance and simplicity of operation, and a logarithmic time base "Logtime" recorder, intended primarily for use with the fatigue tester, will record up to six simultaneous tests on a logarithmic time scale; in this way an endurance curve is plotted automatically.

A portable "level" meter, a development of the Ryall direct reading attenuation measuring set, although of only slightly less precision, has a range of +20 to −35 db on 1 mW in 600 ohms, is portable and compact, and the model shown may be operated from either a.c. mains or batteries. The logscale type of instrument, with which the level meter is fitted, is shown separately, while decibel meters and logscale instruments are of the moving-coil type, fitted with a metal oxide rectifier for use on a.c. and scaled in decibels or in milliamperes.

Short and Mason, Ltd.

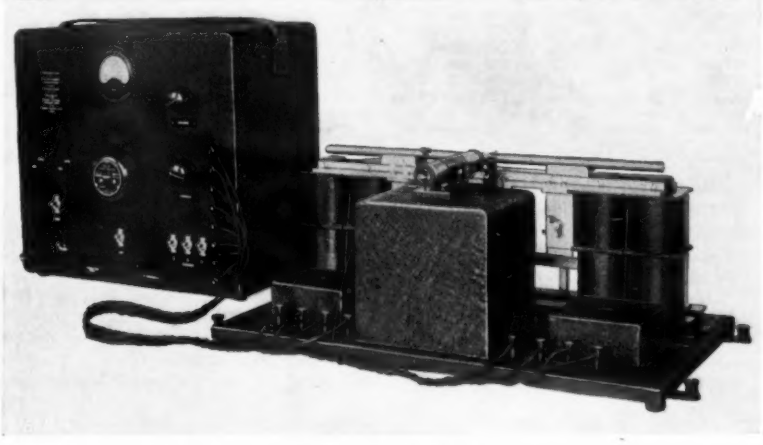
A new design of room thermostat has a quick response, and will withstand overloads without affecting the setting points. A small snap-action switch is incorporated, which has totally enclosed silver contacts capable of making and breaking 5 A at 250 V. An optional feature is a small neon lamp to indicate whether the thermostat is "on" or "off." It is designed to plug into a standard wall plate or to fit into a pendant for suspension from the ceiling.

Standard Telephones & Cables, Ltd.

Equipment for measuring unbalance on telephone toll cables has a frequency range of 100 to 5,000 c.p.s., and an accuracy of ±0.5 db. The chief advantages of a cross-talk measuring outfit, which can be used either with single frequency or complex wave tone, are speed and precision over the wide range of 500 to 25,000 c.p.s. The accuracy of a volume indicator from 30 to 10,000 cycles between +10 and −15 db is within 0.4 db.

The Standard-Sunbury high-speed engine indicator has been developed in conjunction with the Anglo-Iranian Oil Co., Ltd., for internal combustion research. The pick-ups are electro-magnetic, providing an output voltage proportional to the rate of change of pressure in the case of the cylinder unit. The amplifier has a special integrating circuit which can be inserted at will to furnish either conventional pressure diagrams or to indicate the rate of change of pressure on an oscillograph tube.

Other items are noise meters, a multiple frequency oscillator, various amplifiers, and a distortion factor meter, as well as a cathode-ray electro-cardiograph and a triple tube cathode-ray oscillograph with a moving film camera.



Salford fatigue tester

H. W. Sullivan, Ltd.

This display is divided into crystal and fork frequency standards and wavemeters; inductance and capacity standards for all frequencies; capacity bridges and other testing sets; audio-oscillators and a.c. bridges, &c., including recently improved hot-wire ammeters for high frequencies, which avoid inaccuracies associated with the shunting method of range extension.

Synchronome Co., Ltd.

The first model of Mr. F. Hope-Jones' new free pendulum employing a Shortt synchroniser, and also the new "Synchronomains" master clock.

Telegraph Construction & Maintenance Co., Ltd.

Broadcast relay cable, consisting of aerial wire and multicore cables of low capacity, high insulation and negligible cross talk, is insulated and sheathed with "Telconax," which is extremely resistant to moisture and chemical attack, has excellent ageing properties and is exceptionally light and clean to handle. Highly flexible moisture-proof screened single- and two-core cables of exceptionally low capacity and attenuation constant are made for use at radio frequencies, especially with rejectostat systems.

Moisture proof telephone cable, insulated with K-gutta and sheathed with "Telconax," will function in water even with a discontinuous sheath, and it is lighter and more flexible than is its usual dry core lead-sheathed prototype, the electrical characteristics of which are very similar. Flexible, moisture-proof air-spaced concentric cable suitable for operation at very high frequencies up to 5 or more megacycles with an effective dielectric constant not greatly above 1 are capable of being supplied in long continuous lengths. Cable of this type can be manufactured to meet most requirements.

Other items include a demonstration of the screening effect of "Mumetal" in connection with cathode ray oscillograph tubes lent by Messrs. A. C. Cossor, Ltd. An inductor type voltmeter with "Mumetal" core manufactured by Messrs. Nalder Bros. & Thompson, Ltd., shows the wide scale 300 deg. deflection obtainable with this type of instrument. The improvements resulting from the application of "Mumetal" in a sensitive type of relay are demonstrated by the new Carpenter instrument manufactured by the Automatic Electric Co.

"Rhometal" is used for the inductive loading of the most recent type of long-distance submarine telephone cable and thin stampings are used for high frequency generators and in the construction of transformers for cathode ray oscillographs. A new application of this material is in the form of a high frequency transformer designed by the Post Office Research Laboratories; also the new S. G. Brown multiwave tuner employs a core of "Rhometal" wire.

Samples of the resistance alloys, "Pyromic" and "Calomic," drawn to fine wire with an electrical resistance of 2,000 ohms per yard, demonstrate their ductility.

Thermal Syndicate, Ltd.

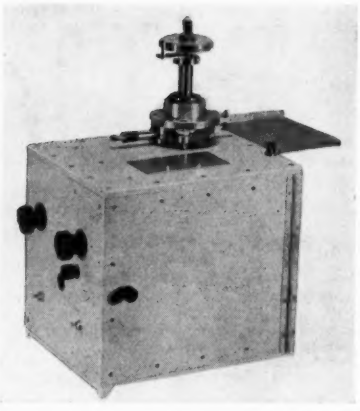
The most recent mercury vapour lamps with fused quartz (Vitreosil) envelopes for medical, scientific, and industrial use are of the discharge type. They are of robust construction, transportable, and can be used in any position, having only a small amount of mercury in the envelope. Suitable auxiliary equipment according to whether the lamp is for d.c. or a.c. enables these lamps to start on the switch without tilting.

The "Vi-Tan" unit is portable and designed more especially for home use. It is suitable for 200-260 V a.c., consumes only 50 W, and is also a convenient source of u.v. light for testing and other purposes.

The incandescent cathode discharge tube unit operates from 200-250 V mains at 2.15 A through appropriate auxiliary equipment for a.c. or d.c. as desired.

H. Tinsley & Co.

Apparatus (illus.) for the measurement of resistance, inductance, capacitance and power factor at radio-frequencies up to 100 million c.p.s. consists of a variable



High-frequency measuring outfit (H. Tinsley & Co., Ltd.)

frequency oscillator (1-100 megacycles) and a balanced valve voltmeter in conjunction with a tuned circuit. The method is to measure the inductance, resistance or capacitance and losses of the tuned circuit before and after insertion of an unknown impedance or dielectric. No corrections are necessary and all results are deduced by simple formulæ from the readings taken on the precision micrometer condensers.

A high-voltage sealed-off cathode-ray oscillograph (Dr. Szegho's design) has a maximum "writing speed" of the beam on the screen of about 1,000 km./sec. with the highest anode voltage (about 60 kV). This compares with the maximum writing speeds of the ordinary sealed-off tubes of about 2 km./sec. The camera is outside the tube and there is no limit to the number of plates that can be exposed in sequence. The oscillograph carriage and control unit and the high voltage supply unit are mounted on wheels so that they can be readily moved.

A portable demonstration galvanometer and a new pointer type of galvanometer are other interesting exhibits.

Ernest Turner Electrical Instruments, Ltd.

In addition to small-diameter instruments in black bakelite cases for flush fitting or projection, there are switchboard types in several sizes of round and sector-shaped metal cases. Also portable instruments, laboratory sub-standards, and radio-frequency instruments.

Venner Time Switches, Ltd.

Time switches for street lighting and other purposes are a.c. and d.c. electrically wound, or hand wound. Some types are fitted with synchronous motors and enable a weekly programme of switching to be preset on the dial.

Oil break switches of the electrically operated type have been improved. There are relays for various purposes, including water heating control in connection with street lighting in New Zealand, and for lighting in G.P.O. telephone kiosks. A buoy lamp for cable ship maintenance work in mid-ocean will operate for eighteen days without attention. There are also wireless lighthouse switches and flashers for controlling signs.

Prepayment, rent collection, "Wrad-Slot," "Cost-i-Meter," fixed and running charge, and two-rate meters are shown, an addition to this range being a dual coin fixed and running charge prepayment meter. A frequency control clock has two dials, one of which indicates correct time (pendulum control) and the other is synchronous motor driven from the supply to be controlled.

The company's hourmeter records operations in terms of hours up to 1,000 for use on controlled frequency supply, while the rebater is for use for off-peak water-heating control. Another type of meter records the time at which a tram-car passes a certain point.

Western Electric Co., Ltd.

The 2B type audiometer for determining the acuity and quality of hearing by means of an oscillator valve, is capable of producing eight pure tones covering the useful speech and musical scale of frequencies from 64 to 8,198 cycles per second in octave steps. The tones are variable in intensity and may be reproduced in either a headphone or a bone conduction receiver.

A sound meter (illus.) consisting of two sections, a subjective comparison meter and an objective meter in one unit, is particularly useful for measurement of short period noises and can also be used as a sensitive valve voltmeter or as a means of measuring absolute sound intensities. With another new instrument for analysing a complex sound into its components frequencies of the order of 1 c.p.s. can be isolated. The selectivity of the circuit gives an effective band width of 1 c.p.s. on the 0-500 c.p.s. range and 20 c.p.s. on the 0-5,000 c.p.s. range. The company's new watch rate recorder is used for the measurement of the instantaneous rate of 5 tick per second watch mechanisms.

A high speed motion-picture timing system photographs simultaneously, at speeds up to 2,500 pictures per sec., images as seen through the ordinary lens system and the moving dials of a high precision electric clock, the basic time rate for which is provided by a thermostatically controlled tuning-fork to regulate the frequency of the current operating the clock.

Westinghouse Brake & Signal Co., Ltd.

As an example of the rapid development of the metal rectifier in heavy engineering applications, attention is called to the electro-plating industry in which equipments up to 12,000 A d.c. output for one unit alone, and 29,000 A for one installation have been supplied. A standard 275-A 6-V plating rectifier illustrates the use of fan cooling, now adopted for reducing the size and weight. A typical metal rectifier is shown on p. 9.

A new high voltage rectifier to be shown for the first time is the "J" type, capable of carrying up to 2 mA. The largest size made, type J176, at this load gives a d.c. voltage of rather over 1,200. Any number can be connected in series for higher voltage outputs, particularly for providing the operating potentials required by cathode ray tubes, and such devices. At the Hammersmith Post Graduate Medical School one of these rectifiers is rated for a continuous output of 10 mA at 400 kV.

Metal rectifiers for a.c. measuring instruments have been further improved as to general manufacturing processes. An automatic trickle charging equipment, developed to meet the special requirements of floating battery systems used for emergency lighting and similar purposes, by the use of suitable control chokes is made to provide almost constant trickle charge under conditions of varying load and mains fluctuations.

Weston Electrical Instrument Co., Ltd.

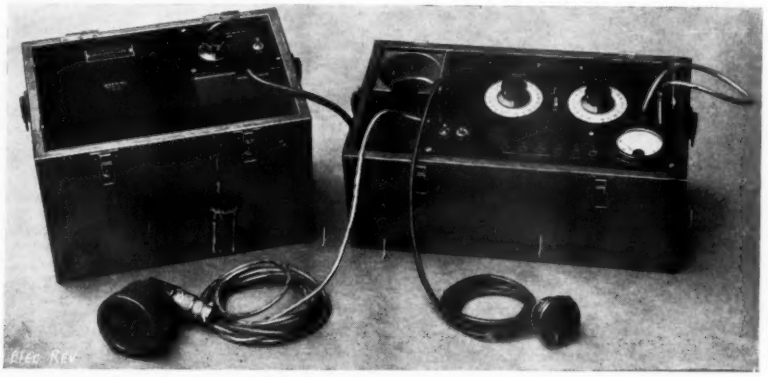
These instruments range from laboratory standards with an accuracy within 0.1 per cent. down to miniature types. Portable testing outfits have various grades of accuracy from 0.25 to one per cent. for a.c. and d.c. use, and potential and current transformers are available within the accuracy limits specified. A new model has been designed to comply with the I.E.E. regulations for the measurement of the resistance of earth leads.

Zenith Electric Co., Ltd.

Sliding rheostats for laboratory use are designed to provide smoother regulation and greater durability. The range for bench use having tubular metal and porcelain formers is equipped with non-inductive and capacity-free windings. Types for back-of-panel mounting have attachments for handwheel operation.

Control resistances for industrial purposes have simplified methods of supporting the elements, resulting in reduced weight and improved ventilation, including types for vaporising volatile fuels, oil engine starting, etc.

Besides regulating transformers of new design with sliding adjustment there are new phase shifting transformers equipped with worm-wheel adjustment and an engraved scale of large diameter. Also to be shown are a portable testing set for house service meters and meter testing accessories and components, "Zenohm" heavy duty corrugated strip resistances in new form for controlling purposes, and "Vit-Bond" and other types of wire-wound embedded resistance units in new type mountings.



Western Electric sound meter

Sealing Metals into Glass

IN the *Journal* of the Franklin Institute for December Mr. Howard Scott deals with recent developments in sealing metals into glass. An investigation of the effects of cobalt on the expansion properties of low expansivity nickel steels revealed that a given low expansivity can be obtained to much higher temperatures by the addition of cobalt to these alloys than without. A particular composition having optimum cobalt content and designated "Kovar" is most suitable for sealing into hard glass. "Kovar" is readily wet by hard glass, that is, the natural oxide formed on it during heating fuses with the glass at glass blowing temperatures. Bubbles may form in the glass adjacent to the metal if precautions are not taken.

"Kovar" in the shape of either rod or tube can be sealed into "Nonex" glass without the use of a beading glass or graded seal. Special precautions to avoid stress concentration and an unusual anneal are required, however. A more favourable glass for use with "Kovar" is clear sealing glass which contracts only slightly less than "Kovar" on cooling from its annealing point to room temperature. Seals of "Kovar" into this glass have a high resistance to thermal shock, are not attacked by mercury, and the metal is readily shaped hot or cold and is easily machined. It is desirable for a metal to have somewhat higher mean expansivity than the glass into which it is to be sealed, except possibly when the joint is tubular. When the metal has a higher mean expansivity than the glass, successful seals can be made even with tubular shapes and when there is a considerable discrepancy in expansivity by avoiding high tensile stress concentration in the glass. If the strain point of the glass is above the inflection temperature of "Kovar," annealing overnight at a temperature below the strain point may be required.

Tolerances on Guarantees.

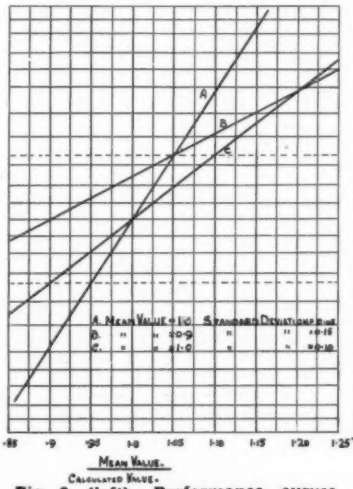
By E. T. Norris, M.I.E.E.*

Their desirability or otherwise in relation to technical performance

THE technical performance of most electrical machinery and apparatus cannot be predetermined with exactness. This is due to disturbing factors over which the designer has no control, such as variations in the quality of the materials used and irregularities in construction and assembly. Assuming sufficient technical knowledge and skilled manufacture, it will usually be possible to eliminate all kinds of consistent error. The designer can then accurately predetermine the mean or average value of any given characteristic, but this value will be subject, due to the above causes, to variations more or less serious and governed by the vagaries of chance.

These unavoidable variations have led manufacturers to introduce guaranteed values subject to tolerances. The desirability of tolerances has for many years been discussed between manufacturing and purchasing interests, and is still a matter of controversy. Consideration of the problem depends upon whether the guarantee is one affecting safety, quality or suitability of the product, and upon whether variations on either side of the guaranteed value are equally objectionable.

In the case of guarantees of losses, variations in one direction only (*i.e.*, in excess) are objectionable to the purchaser, but a design having losses much below the guarantee to cover all possible variations on test is more expensive to the manufacturer. There is a good deal of sophistry in the discussion of this particular subject. Many manufacturers are in the anomalous position of insisting on tolerances through their standardisation committees and trade associations, while at the same time assuring prospective customers that they always design well within their guarantees and do not make use of the tolerances. I suggest that both of these attitudes is not only technically incorrect and logically unsound but commercially unnecessary.



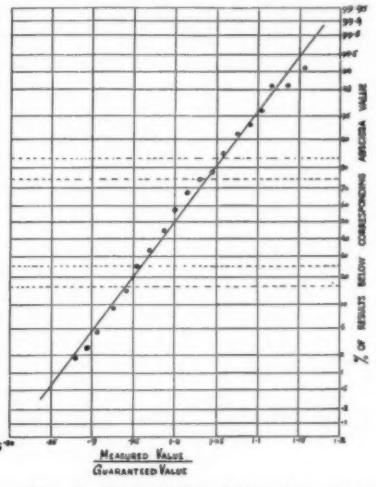


Fig. 2 (left).—Performance curves. Fig. 3.—Probability chart for transformer reactance measurements

The Problem

In general, the problem appears to the manufacturer in the form of a collection of test measurements of any particular characteristic, many of which depart appreciably and more or less seriously from the calculated or expected value. Fig. 1 illustrates a typical case. Here a number of measured values (645 test results) are plotted as a percentage of the calculated or expected value. For convenience they have been grouped into class intervals of two per cent. increment. Although the majority of the test results are equal or close to the calculated value, a large number are appreciably higher or lower, and extreme values vary as much as ± thirty per cent. The

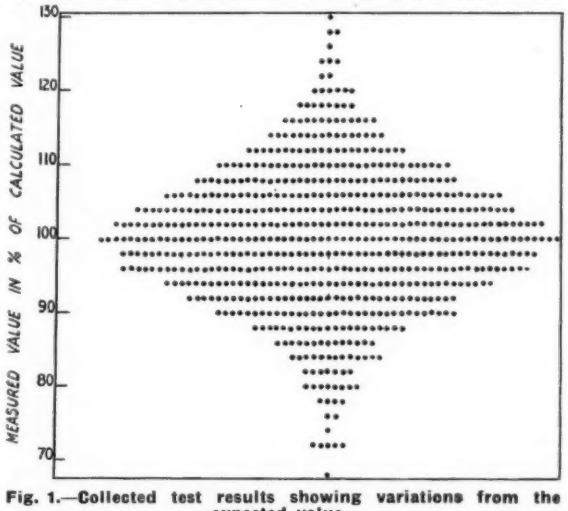


Fig. 1.—Collected test results showing variations from the expected value

problem for the manufacturer is to determine, from information such as this, the best value to guarantee to a purchaser.

Let us assume that a tolerance of ten per cent. is permitted and that the values represent a loss measurement so that only values in excess of the tolerance are objectionable. Clearly, the manufacturer cannot quote the mean expected value of 100, because not only would nearly half of his test results be over the guaranteed value, but twelve per cent. of them would exceed 110, that is, the guaranteed value plus the tolerance. It is unlikely that a rejection on test of one in eight machines would be permissible. If the guaranteed value is raised to 105, thirty per cent. of the results will be over the guarantee, but the number rejected on test, and thereby giving trouble to the manufacturer, will be reduced to six per cent. If the guarantee is raised to 110, then only one in seventy-two machines will give trouble on test. On the other hand, not only is the machine now less competitive, since the guarantee loss is ten per cent. higher, but the guarantees will not be doing the machine justice as more than half the results will be ten per cent. better than the guaranteed value and some nearly forty per cent. better.

In general, the determination of a guarantee which is not to be exceeded is influenced by four considerations, as follows:—(1) The guaranteed figure itself should be as low as possible in the manufacturer's interest in order to make his offer as competitive and attractive as possible. (2) The likelihood of rejection on test, due to the measured value exceeding the guarantee or tolerance, must be limited. This limit will depend upon the difficulty of correction, upon the effect of rejection on the organisation of production, and upon the delay in delivery to the customer. The choice of guarantee as limited by rejection on test is, therefore, dependent upon local manufacturing conditions and upon the size and type of apparatus. It is often the determining factor where the variability is relatively large. (3) When a tolerance is allowed, it is permissible for the measured value to exceed the guarantee. The proportion of test results in which the guarantee is exceeded should not, however, be large, or the customer is apt to feel that he is not getting the value he paid for, and this consideration may be a determining factor in the choice of guarantee. (4) Where no tolerance is allowed, the average measured value will be something below the guaranteed value. This is also true in many cases where a tolerance is allowed. Although an average measured value well below the guaranteed value is satisfactory to the purchaser, the manufacturer has no credit for it in the quotation stages, and he will feel unnecessarily handicapped when his guaranteed value does not do justice to the actual product. This consideration must, however, usually be subordinated to the above factors.

Methods of Analysis

In the ELECTRICAL REVIEW of May 3rd and July 19th, I described a method of analysing the available test measurements of any given technical characteristic in order to predetermine the best guaranteed values for tendering purposes. The results of the analysis form a straight line when plotted on probability paper, as in fig. 2. The slope of the line is a measure of the variability (standard deviation) of the test results; for no variability at all the line would be vertical. The average value, being that value having fifty per cent. of the results above or below it, is the abscissæ reading corresponding to fifty per cent. ordinate value. Change in the mean value is, therefore, indicated by horizontal displacement of the curve.

Curves for three different conditions are shown; C has the same mean value as curve A, due to its greater slope, the

* Chief designer, Ferranti, Ltd.

variability is greater, while B indicates both a lower mean value and a greater variability than either A or C.

The need for tolerances depends on whether variations in one direction only (one-way tolerances) are objectionable or whether variations on either side of the guaranteed value are equally objectionable (two-way tolerances). Examples of the former include loss and efficiency guarantees, while transformer impedances, instrument readings, &c., require two-way tolerances.

One-way Guarantees

Dealing with one-way guarantees, if a ten per cent. tolerance is allowed, increasing the guaranteed value reduces the risk of trouble and the proportion of results exceeding the guarantee, at the expense of making the machine less competitive in the quotation stage. For Grade C material, raising the guarantee ten per cent. reduces the likelihood of rejection on test from one in twenty to one in 250 machines. The change in guarantee has no effect on the actual product. The quality of the machine is unchanged because the average value and the standard deviation are the same. The purchaser does not, however, know of this condition, so that the lower guarantee would be the most attractive to him in the quotation stage, but the higher in the delivery stage.

The curves A and C in fig. 2 compare two grades of material of the same apparent quality (*i.e.*, the same mean value) but differing in variability. For the same guarantee the use of material C will involve more trouble and more running into the tolerance. This can be avoided by raising the guarantee. If the number of test results exceeding the guarantee is the most important factor and seventeen per cent. is the desirable limit, the guaranteed value must be 4.8 per cent. higher for material C. Even so, this material will give more trouble through rejection on test, namely, 1 in 45, compared with 1 in 660 for material A.

If the risk of rejection is the determining factor the guarantee for grade C material must be eleven per cent. higher than for grade A in order that the rejections on test shall not be more than 1 in 100.

A reduction in the mean value is, other things being equal, pure gain. This advantage may be completely nullified if, as frequently happens, the reduction is accompanied by a greater variability. Let us suppose a manufacturer changed from material A to material B, of approximately ten per cent. better quality, at the same price. If he reduced his loss guarantee ten per cent., expecting other conditions to remain as before, he would be shocked by finding approximately one in five machines rejected on test, and many more over the guarantee. This shows the limitations of specifying only the average quality of the materials used. Statements of the worst values involve, perhaps, less risk, but may be even more wasteful. The ideal purchasing specification should include a statement that variations follow the normal law of probability, and the actual values of the standard deviation.

Absence of Tolerances

If no tolerance is permitted there is no distinction between the results exceeding the guarantee and the results giving trouble through rejection. The absence of a tolerance will, therefore, materially affect the guaranteed value where the former was the predominating factor, and the appropriate modifications may be calculated from the probability charts.

As an example, assume that a tolerance of ten per cent. is allowed, and that, in order not to have too many test results running into the tolerance, the guaranteed value for grade C was 116, giving six per cent. of the results over the guarantee and a rejection of only 1 in 250. If the tolerance allowance is now withdrawn, the guaranteed value need not be raised by ten per cent. to 127.5, but can be reduced from the figure until some other factor predominates, say, to 120 with a rejection limit of 1 in 45. The guaranteed value will now be only 4.4 per cent. higher than when a ten per cent. tolerance was allowed. To carry the example further, if five per cent. rejection were permissible the guarantee without tolerance could be 116, or the same as with the tolerance. This extreme result means, of course, that when the tolerance was allowed it was, for other reasons, not taken advantage of.

It seems, therefore, that if guaranteed values are determined in accordance with the method here described, the manufacturer need not be anxious for tolerance allowances.

In general, the chief argument for a tolerance allowance on loss or efficiency measurements is that the guarantees then give the purchaser a better indication of the most probable performance—a result in many ways fairer to the manufacturer and of more value to the customer.

While two-way tolerance allowances are not theoretically essential, the need for them is obviously much greater than in the case of one-way guarantees as the manufacturer has no upper or lower safety zone. Some definite allowance must be considered necessary in practice. The need for a tolerance depends on the product of (a) the accuracy of predetermination and (b) the ease of adjustment on test.

Accuracy of predetermination includes the following factors:—(1) Correctness of quotation; (2) adaptability of standardised parts; (3) accuracy of calculation; (4) consistency of material characteristics; (5) accuracy of shop processes; and (6) accuracy of measurement. These components of (a) can be reduced to a definite minimum determined in any particular case by technical knowledge and production methods representative of the best modern practice.

The net result of (a) will be an average performance consistency which may be represented, as in the case of one-way guarantees, by a probability chart such as fig. 3. If correction or adjustment on test is practicable, the need for a tolerance as determined by (a) will be reduced as only results outside the range of (b) must be scrapped, those inside involving merely cost to the manufacturer and delay to the purchaser.

The Purchaser's True Interest

The tendency of the purchaser is to press for smaller and smaller tolerances. This procedure is not altogether in the purchaser's own interests. It is certainly desirable to the extent possible economically by improvement in (a), *i.e.*, by reducing the standard deviation. There are, however, definite practical limits to many of the components of (a), especially items 2, 4 and 5. For example, fig. 3 shows an analysis on the basis previously described of a number of transformer reactance measurements. If a tolerance of ± ten per cent. is allowed, 9.5 per cent. of the test results will be outside the limits. Assuming that, say, seven per cent. of these cases can be corrected under (b), involving some delay to the purchaser and extra cost to the manufacturer, the remaining 2.5 per cent. must be scrapped at, in the long run, the purchaser's expense. If the tolerance is now reduced to ± five per cent, then thirty-six per cent. of the results will involve rejection on test. On the same basis as before, fifteen per cent. will be scrapped, which is a proportion neither economically nor practically justifiable. In this case a tolerance of ten per cent. appears desirable.

Using this method of analysis, the risk of rejection may be determined and balanced against the ease of adjustment in respect of cost and time. In this way, the need for and amount of tolerance can be accurately assessed for any given technical characteristic.

The general conclusions to be drawn from the foregoing are:—(1) that tolerances on loss and efficiency guarantees (one-way guarantees) are neither necessary nor expedient to the manufacturer; and (2) that tolerances are necessary in practice on guarantees of instrument readings, impedances, etc. (two-way guarantees). In both cases the most suitable values of the tolerance and of the guarantee can be determined by the method described.

A Large Hydrogen-cooled Frequency Changer

THE *Electrical World* reports the installation by the Pennsylvania Power & Light Co. at its Freemansburg substation of a hydrogen-cooled frequency changer rated at 20,000 kW in hydrogen and 17,500 kW in air. Estimates having indicated that an air-cooled set in an outdoor steel housing would cost about the same as an outdoor hydrogen-cooled set, the latter unit was selected because of much lower losses. Also, due to a lack of oxidising agents in hydrogen, there is an expected longer life of insulation and bearing oil, freedom from corona and practical freedom from fire damage. The relatively low cost of the hydrogen set, in spite of its more expensive construction, is due to the greater heat transfer capacity of hydrogen, making it possible to use a smaller carcass and coolers than would be necessary for an air-cooled machine.

Deep well water at 52 deg. F. is supplied to eight hydrogen coolers and four bearing oil coolers. External water boxes at top and bottom of the coolers permit the cleaning of tubes during operation, while for tube replacements the coolers will be lowered into the pit under the machine. Cooling coils imbedded in the bearings use oil circulated through surface coolers. Oil is used in preference to the more commonly used water, since should a leak develop the bearings are relatively inaccessible in the hydrogen-filled shell. Excitation is supplied by a separate four-unit set.

A crane used during erection was removed and any major repairs will be done with the machine on the foundation. A system of beams and jacks is provided to support the rotor while the uncoupled outboard bearing and stator sections are being moved on small roller trains along the bedplate clear of the rotor winding. Any rewinding will then be done in place. Acceptance tests run on the installed set indicate that the efficiency is above the manufacturer's guarantee and is very high for a frequency convertor. The set was made by the American General Electric Co.

Hydraulic Turbine Control. By F. Johnstone Taylor

Features of modern governor mechanism

THE governing of hydraulic turbines has always presented a difficult problem. The heavy masses to be moved on the one hand and the close speed regulation required in modern a.c. work call for a costly piece of mechanism of extreme sensitiveness and accuracy. Sometimes special features such as a motor-driven ball head with a pilot exciter drive, head-level control, speed matcher, gate limiting device and protective equipment associated with automatic and remote control may also be needed.

The general principles are simple enough, *per se*. Instead of moving the turbine gates the essential flyballs (motor or power driven) control the medium (oil pressure) which is available for so doing. The flyballs act on the pilot valve and control, through the relay valve, the motion of the piston in the operating cylinder, which, moving to left or right, opens or closes the turbine gates; additional control, such as an excess-pressure valve or blade-adjusting mechanism, will not affect the principle as a whole.

Compensation Motion

For a small turbine driving a d.c. machine the controlled motion of the gates suffices, but the operation of large a.c. machines in parallel demands a good deal more in the nature of compensating motions and other equipment. The motor-driven ball head has recently come into general use. Supplied with energy by a permanent-magnet generator directly connected to the main generator shaft, it comes into action in the first fraction of a turn of the main shaft, and is always in synchronism with it. In fig. 1 the ordinary type of flyballs shown are in their normal position for respective speed and no-speed droop, and by means of the pointer the load limit is set at 9/10 load. The pilot valve and the compensating plunger are central, and the power piston is stationary.

Assuming a decrease of load, as the flyballs fly out the speeder rod is forced down against the upward thrust of the speeder spring and pivots H, I, B and A (centre) are forced down. The pilot valve plunger descends from its central position against the upward thrust of the pilot-valve spring, and pressure oil is admitted through the upper holes in the

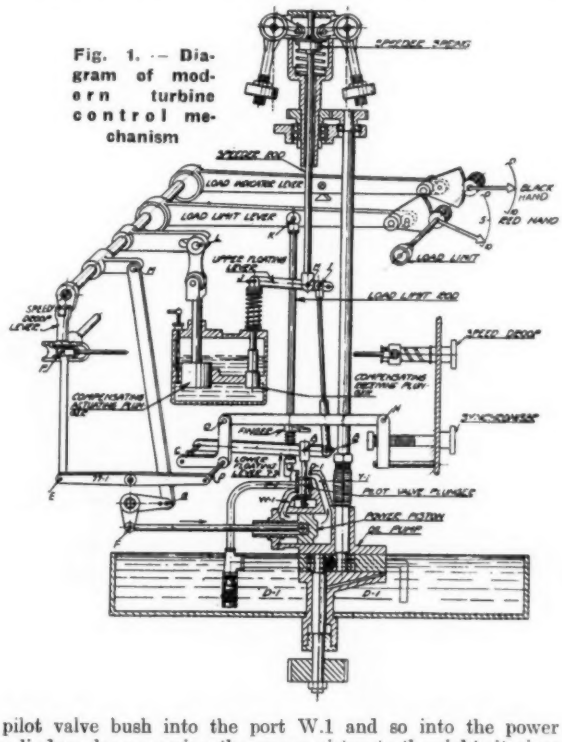


Fig. 1.—Diagram of modern turbine control mechanism

pilot valve bush into the port W.1 and so into the power cylinder where, moving the power piston to the right, it gives a closing motion to the gates. Meanwhile, the oil in the other end of the cylinder has been forced out in proportion through the other port and back into the tank.

As the power piston moves to the right the pivots G, M and L are raised and the larger actuating compensating plunger is also raised; as the compensating dashpot is filled with oil the upwards motion of the compensating actuating plunger sucks the smaller one downwards against the upward force of the compensating spring. Pivot J is now pulled downwards and, with the pivot H temporarily stationary, the pivots I, B and A are raised and so is the pilot valve plunger. These short sequential movements continue until the pilot valve plunger is raised to its central position which stops the flow of pressure oil to the power piston.

By this means, given proper adjustment of the parts, the pilot valve plunger is centred and the power piston stopped with the gates in a new position exactly corresponding with the speed required by the load; in other words "hunting" is eliminated. The flyballs will return to their central position by reason of a flow of oil through the compensating needle valve bringing the receiving plunger back to its central position, and on completion of this cycle the black hand will be showing the new loading point. Increase of load will result in a reversal of these motions.

Working in conjunction with the red hand is the load-limit device. Its purpose is to prevent the unit from taking more load than that to which this red hand is set; it does this by restraining the pilot valve plunger from rising above the centre when a load corresponding to the setting of the red

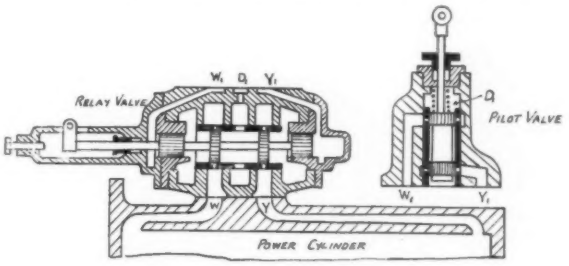


Fig. 2.—The relay and pilot valves

hand has been reached. Furthermore, by turning this hand to zero the unit can be shut down. As the power piston moves to increase the flow of water the compensating crankshaft is turned clockwise and the load limit eccentric lowers the end of the load-limit lever while the right-hand end is held stationary. Pivot K and the load-limit rod are forced downwards, and so is the finger on the lower end of the load-limit rod. As the power piston reaches a position corresponding to the setting of the red hand, this finger makes contact with the top of the pilot valve plunger A and prevents it rising, so that there can be no further increase in the flow.

If the red hand is set to zero the right-hand end of the load-limit lever will be forced downwards, pushing down the load-limit rod, the finger and the pilot valve plunger, thus admitting oil to the power cylinder so that the piston moves to the right. This action closes the gates and raises pivots G and M; the compensating camshaft turns anti-clockwise and the load-limit eccentric raises the left end of the load-limit lever. Pivot K is raised, centring through the load-limit rod the pilot valve plunger, which stops the action just as the power piston reaches a position corresponding to the setting of the red hand.

The speed droop adjustment is connected to pivot P of the speed droop lever on the left of the diagram. In the normal position it has no effect, but if turned so as to move this pivot towards the right and so off its centre, the compensating crankshaft will be revolved clockwise and will move the upper end of the speed droop lever to the left. As a result E is raised, D and C are lowered, pivot A is lowered with respect to B, the pilot valve will be centred and the power piston will be stopped before it reaches a position corresponding to the original speed. That is to say, the unit will not return to the speed at which it was operating, but to a somewhat lower value determined by the movement of the speed droop adjusting knob.

Synchronisation

Below this knob will be seen the synchroniser, which allows the speed of the set to be varied while it is being synchronised with other sets. If it is operating in parallel on a system many times its own individual capacity an adjustment of the speed setting will result in a change of the system speed, though it may be insufficient to be read on the instruments.

Practically, therefore, a change in the synchroniser setting merely changes the loading of the unit due to the small amount of influence the capacity of the unit has on the total capacity of the system. When the synchroniser knob is turned, pivot O is pulled towards the right and pivot C is raised, thus permanently raising the left end of the lower floating lever. This will raise pivot A with respect to pivot B, and pressure oil will be admitted from P.I to port Y.I. The power piston moves left to open the gates, and the set will speed up till the

flyballs have changed their normal central position an amount sufficing to re-centre the pilot valve plunger.

Acting on the speeder spring of the governor through a differential gear are two three-phase squirrel-cage motors. One, the bus motor, rotates in a direction to increase the speed of the unit, and the other, the machine motor, rotates in a direction to reduce it. Therefore, one motor driven in one direction from the bus and the other in the opposite direction from the oncoming machine will, by their difference in speed, cause the horizontal shaft of the differential gear to adjust the tension of the speeder ring of the governor to match the speeds.

When the frequency of the unit and the bus are nearly identical both motors will be operating at the same speed and will cease to affect the governor. At correct phase synchronism the circuit breaker will connect the unit to the bars and the machine motor is stopped, though the bus motor is still in operation. The strength of the speeder spring is now smoothly adjusted by the machine motor slowing down. The set takes on load, and when the proper gate opening has been reached the pointer of the speed matcher control switch is set on its mark and then pulled out for the purpose of disconnecting both motors.

Applications of the Thyratron

THE type of thermionic valve rectifier which operates with a hot cathode and is grid controlled is known as a thyratron, that word being a trade mark of the British Thomson-Houston Co., Ltd. Some of the industrial applications of this device for control purposes are reviewed in the paper by Mr. A. L. Whiteley which was read at the Institution of Electrical Engineers in London on January 2nd.

The thyratron itself is first described, reference then being made to some elementary principles which must be observed when designing circuits suitable for use with it. The grid circuit, especially, gives rise to problems and operating features probably not hitherto met with in industrial control apparatus. Though originally developed as a sensitive relay, the thyratron valve has now reached the stage at which it is able directly to control power of some magnitude, though the controlling power needed for the grid circuit is very small, and thus has uses other than relaying.

The life of such a valve and the cost of this means of control are dependent upon each other. The author admits that the average life of the thyratron does not compare favourably with that expected of the usual forms of control gear or machine, but he points out that the life of a thyratron interrupting a circuit 1,500 times per minute is likely to be longer than that of a contactor operating at only one-tenth the speed. Further, when the complete circuit is examined it is often found that the thyratron is the only part which will need renewal, whereas the alternative apparatus has perhaps many moving parts which must be "serviced."

A guarantee of 2,500 hours' life is common with hot-cathode rectifier tubes, though the average life expectancy is longer. A longer life may be expected if the tube is somewhat underrun as regards anode current; this, of course, is equivalent to raising the price of the thyratron.

When the anode current to be carried by the thyratron exceeds about 0.5 A, an initial heating period must be allowed for before load can be carried by the thyratron. This time of heating may be five minutes or more. As, however, the power consumed by the cathode heater is small, it is feasible to keep the cathodes hot over long intervals, even when no anode current is passing; it is also preferable from the point of view of tube life. There is some difficulty in affording protection from short circuits. Fusing of circuits may not give complete protection to any thyratrons installed, since, in the case of a heavy short-circuit current, damage may be done to the cathodes before the fuses blow. Where a transformer supplies anode power, its short-circuit impedance will usually limit the anode current to a value which will not cause destructive action on the cathode during the brief interval of a short-circuit.

Difficulty is sometimes encountered in providing adequate ventilation of the thyratrons. Where the ambient air can be maintained between about 5 deg. C. and 40 deg. C. no difficulties are likely to be encountered due to change of grid-control ratio.

A number of grid circuits are available which will function satisfactorily with a very considerable change in grid-control ratio. Where the thyratron is used for measuring applications and the like, and constancy of characteristics is necessary, an argon-filled thyratron may be used.

Breakdowns, &c., in the anode circuit of a thyratron usually manifest themselves in a manner similar to that of other types of control apparatus and are readily detected. In the grid circuits, however, the cause of any incorrect functioning may be very difficult to trace. This is especially true on site, where the usual maintenance staff fails to appreciate the mode of operation of the equipment and is not equipped with apparatus suitable for detecting faults in high-impedance circuits. It is, therefore, clear that grid circuits must be designed with very adequate safety factors with regard to heating, insulation, etc.

Fragility is understandable, since glass is employed, but as the thyratron is invariably mounted in an enclosing case away from the operation it is controlling, it is rendered no more fragile than other types of control apparatus. Transportation to site requires more care than is bestowed upon other apparatus.

Industrial Research

THE annual report of the Department of Scientific and Industrial Research for the year 1934-35 (Cmd. 5013 H.M. Stationery Office, 3s. net) records an encouraging response to the offer which the Department made last year to research associations of increased Government support, provided the associations on their part obtained correspondingly increased contributions from the industries they serve. Negotiations with thirteen out of eighteen research associations in receipt of financial assistance from the Department have been completed and in every case offers of increased grants on a new basis have been accepted.

The associations in question, as a whole, are already assured of a 30 per cent. increase in their resources as compared with those they commanded eighteen months ago. With one exception each now enjoys an income of at least £10,000. The income of E.R.A. has increased in two years from £44,000 to £64,000.

Summaries of the work of the Department's various organisations commence with the National Physical Laboratory, whose activities have already been reviewed separately (ELEC. REV., May 17th, p. 712).

It is recorded that the Fuel Research Board has devised a method by which a stream of air-borne powdered coal can be divided into two or more equal parts, each carrying exactly the same amount of coal of each separate size, for feeding two or more burners.

The Food Investigation Board is studying the disinfection of meat (destruction of bacteria) by means of rays of alpha, beta and other particles, the relative velocities of disinfection being approximately, but not exactly, in the ratio of the ionisation produced. To determine the amount of fat in meat a method has been devised of measuring the electrical resistance rapidly, which indicates the thickness of layers of fatty and muscular tissues to one millimetre, and can be used for grading carcases intact.

The Building Research Station has nearly completed a new heating laboratory in which it will be possible to accelerate and extend investigations into the nature and magnitude of heat interchanges associated with houses built of different materials and heated by different methods.

The Steel Structures Research Committee is preparing its final report, which will include conclusions formed about electric arc welding as a result of tests made at the N.P.L. Electro-deposition research has continued at Woolwich, now under the supervision of the British Non-ferrous Metals Research Association. Chemical research has included synthetic resins, phenolic samples of which have been prepared under standard conditions (in collaboration with E.R.A. and the N.P.L.) for electrical testing.

The progress of the Radio Research Board's work has been referred to separately. Illumination research has concerned street and motor car head lamp glare. Investigations are being made with luminous discharge lamps to discover the advantages of particular colours for street lighting. Considerable progress has been made with a scheme for calculating the illumination required for an industrial process from a knowledge of the various elements making up the task, such as size, movement and contrast. A Standard Specification is being prepared for "artificial daylight" lamps and fittings for colour matching purposes.

Further work has been done at the N.P.L. in connection with industrial applications of X-ray analysis on magnet and transformer steels, in continuation of the study of the relation between magnetic properties of steels and their structure as revealed by X-ray analysis. The work of E.R.A., with which we have already dealt, is briefly referred to.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Heating and Ventilation

In your issue of December 13th Mr. Ackery reviews portions of the recently published three-volume book entitled "Modern Heating and Ventilation," and a considerable part of his remarks are addressed to the section on "Electric Heating."

As the writer of this section, I am gratified to note the care with which Mr. Ackery has studied the work, and that out of sixty pages he can find so little cause for criticism. Apart from an obvious mistake in simple calculation, which I will deal with in a moment, the main criticism is that the information given is not right up-to-the-minute. In this connection it will be appreciated, I think, that in a work of this magnitude it is inevitable that some considerable time is required for the compilation and co-ordination of the various sections, and it so happens that the section on electric heating was written before the issue of the 1934 Regulations of the Electricity Commissioners. Fortunately, electrode boilers are usually installed under competent advice and supervision, so that the change in practice since the section was written will be well known to all concerned.

Similarly, a work of this nature cannot be regarded as a catalogue of this season's newest designs of fires and water heaters, but as a general guide to the underlying principles and the practicability of electric heating.

With regard to the distinction between low-temperature and high-temperature panels, may I suggest that Mr. Ackery has overlooked the statement on page 187 that "high-temperature panels . . . are particularly suitable for the heating of spaces in which the ventilation is unusually high, *e.g.*, schoolrooms."

And now for the obvious mistake referred to above. The quantity of water required to give a good bath should have been given as 12 gallons (not 6) at 160 deg. F., mixed with an equal quantity of cold water, *i.e.*, 24 gallons in all (not 12). This quantity of hot water can be obtained for the expenditure of about 4 kWh.

I do not admit that it is incorrect to claim that, in an arrangement where an electric storage heater is in series with a coke boiler, the consumption of electricity is practically nil when the coke boiler is in use. It is true that radiation losses from the electric heater must be made good, but if the coke boiler is working at anything like its proper load and if the storage heater is adequately lagged, the losses to be made up are very small. It depends on one's interpretation of "*practically*" nil.

J. F. STANLEY.

Thornton Heath, Surrey, *December 24th.*

Railway Signalling

Major L. H. Peter, in his I.E.E. paper on railway signalling, reported in your issues of December 6th and 13th, expressed a preference for railway signals in the loco. cab instead of on the line. This system would, however, take away the tendency of the driver to keep an eye on the track. Some years ago an express ran into a herd of cattle, which had strayed on to the line, and it was derailed, fortunately without serious damage. It is said that the driver, when asked what he did when he saw the cattle, replied: "I shut off steam, threw on the brakes, and waited for eternity."

The point of this story is that if the signal had been in the cab the driver might not have been looking along the line and the accident might have been much worse. Apart from level-crossing accidents, there was a recent case where some schoolboys were brought before the court because they had been daring each other to keep their heads on the line the longest time when a train was approaching. Even if a perfect signal could be invented for use in a cab it might be a doubtful blessing.

Major Peter referred to the curious fact that, while it is often difficult to start a current in a running contact, once started, it will keep flowing. I believe that it was discovered, for telegraph purposes, that a condenser across the contacts helps a current to start, but whether this would be an advantage for railway purposes I do not know. I tried this once, and it appeared to improve the reliability of making the circuit through metallic contacts.

There appears to have been difficulty with track circuits for signalling purposes when the track is gauged by a metal bar as it short-circuits the current, but this could easily be overcome by cutting the gauge bar and joining it up again through an insulating joint. For the low voltage concerned it would be quite an easy matter to make the joint strong and light.

The hump method of sorting wagons involves much electrical apparatus for operating points, &c. In the ordinary method, when a train of wagons is sorted into sections to be sent in different directions, the wagons are detached in ones and twos and are pushed by a shunting engine on to the sidings on which the new train sections are being made up. It is a long job, and the use of a series of moving cables alongside the sidings to which the wagons might be hitched and pulled into position has been suggested.

A better method is to use gravity, by backing the original train to the top of a slope, where the wagons are detached so that they run down the other side at a sufficiently high speed to carry them to the farthest point on the farthest siding. By an elaborate system of points, worked electrically, each wagon is diverted to its proper siding, and a long train can be rapidly sectionalised. At first, the moving wagons bumped into stationary ones with such severity that the goods were damaged. This has been overcome by the ingenious brakes discussed by Major Peter.

Electrical designers who study this paper will find scope for ingenuity in improving railway transit methods.

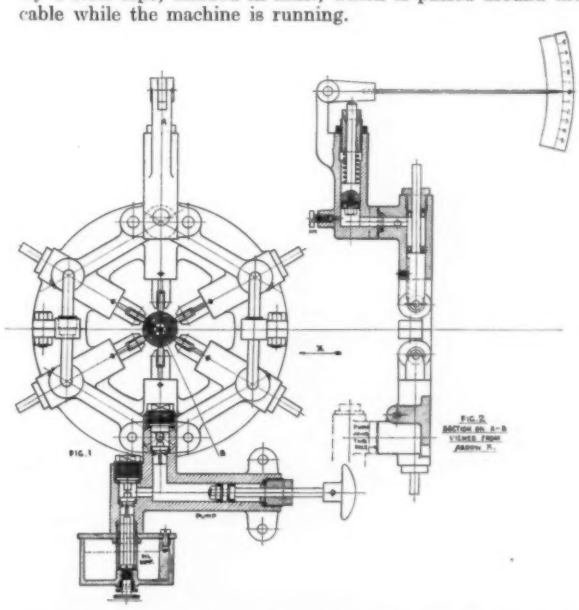
C. TURNBULL.

Tynemouth, *December 23rd.*

Measuring Cables

As one who has had many years of experience in both cable manufacture and machine-tool design, I consider that the electrical industry can learn something from tool makers. The following suggestion may commend itself to some of your readers.

Continual measurement is very necessary at every stage of cable manufacture, but unlike work done on the lathe and grinding machine, the part to be measured does not revolve; it only moves from left to right. In insulating some cables over 100 paper strips are added at one operation. The operator has continually to check the final outside diameter, which must be kept within fine limits in order to avoid trouble when the cable is lead covered. The diameter is generally measured by a steel tape, marked in mils., which is passed around the cable while the machine is running.



The accompanying drawing illustrates a proposal for measuring hydraulically. The instrument consists of two gun-metal castings bolted together at the horizontal centre line. In each casting there are three pistons, in which ports are drilled for connecting one to the other by brass pipes with union joints. A hand pump is bolted to the bottom boss and a seventh piston is bolted to the top boss. The seventh piston, which is spring-loaded and easily adjusted, operates a needle with a leverage of ten to one. The instrument is fixed to the steady (which is generally of the four-roller or split-die type) near the draw-off drum.

When the "theoretical" number of papers have been wrapped round the conductor, the cable is measured by means of a steel tape and if the diameter is correct, the hand pump is operated and the oil pressure forces the six rollers against the cable. Probably a pressure of a few lb. per sq. in. will be

sufficient. By adjusting the spring and pressure the needle is made to read zero when the cable is of the correct diameter.

The variation of the cable diameter is caused by the difficulty of keeping a uniform tension on all papers; also the thickness of each paper may vary slightly. Any difference in diameter is transmitted from the six hydraulic pistons to the seventh piston, and recorded by the needle. The operator needs only to watch the needle and add more papers or reduce the number according to whether the needle moves down or up. The needle could be arranged to make electric contacts to ring a warning bell when moved to the maximum in either direction.

For special test cables, the needle could be fitted with pen and ink to mark a chart on a revolving drum, the line drawn showing the variation in diameter for the full length of the cable. When a length of cable is completed, the suction valve is lifted by turning the milled head of the rod which passes through the centre of the oil sump. All the six pistons are pushed back, ready for the next cable. The rod is then turned back.

The apparatus would be suitable for shaped as well as circular cables, and could be applied to checking the outside diameter of the lead covering. BOUCHER.

December 24th.

Multiple Earthing

In his article in your issue of December 27th Mr. T. C. Gilbert argues against multiple earthing and apparently against the use of neutral relays, but I suggest the arguments against the first are in favour of the second. If the earth resistance is low, then the conventional trip coil will be more definite in its action for that reason. Low earth resistance usually implies buried pipes and cables, all of which provide parallel circuits to a neutral conductor when earthed at a number of points; therefore trouble from electrolysis may be expected without appreciable gain in tripping efficiency.

In rural areas, where the earth resistance is usually high, the resistance of trip circuits includes that of the earth between their earth electrodes and that of the neutral, which may be at a distant transformer. The only gain from multiple earthing is to bring a neutral earth plate nearer to that of the earth-leakage trip device and thereby reduce the earth resistance in its circuit. High earth resistance indicates that the earth will not conduct a sufficiently heavy leakage current to operate overload trips or fuses. The case for the neutral relay is mainly that the leakage current which energises a trip device is from phase to some point of the neutral, either at the transformer earthplate or, with multiple earthing, to a local earthplate. Why not therefore connect the trip device between the casing of consumers' apparatus and the service end of the neutral, thereby gaining a definitely low resistance and continuous metallic circuit for the leakage current and, in addition, save the expense of earthplates?

Mr. Gilbert's principal objection to the neutral relay appears to be that it would not function when a break occurred in the neutral of an overhead line. I explained in an article which you published on September 20th that even then the relay would function as a conventional trip connected between consumers' apparatus and earth. The trip coil, being simply centre-tapped to the neutral, would not affect a leakage current passing through the coil from consumers' apparatus to the coil earth electrode and then *via* earth to the transformer earthplate.

Phase as well as neutral lines may fall to the ground, but the series coil of the neutral relay disconnects an installation whenever a dangerously high voltage is present between the consumers' apparatus and earth. The series coil is optional but is advisable in such an instance where a 400/230-V overhead system supplies three services, each tapped from phase and neutral. If the line connected to phase A falls to ground then the services at B and C will be at 400 V to earth, and even a slight leakage increases the risk from shock. Although the earth resistance between the three services may be low (as in the case of farms on low ground) its value between the farms and the transformer—if on a high level or at a considerable distance—may be so high that the conventional trip device would not be energised. The local risk at services B and C is maintained, whereas each neutral relay in a given area provides a local earth leakage path to the neutral conductor for any neutral relay operating as a conventional earth-leakage trip consequent upon its local disconnection from the neutral conductor; hence the advantages of multiple earthing are gained without the disadvantages.

A stray earth current considerably in excess of the normal energising current of a neutral-relay tapped coil may be employed to trip the relay at the site where its presence is dangerous by adding a series coil to the relay. Telephone lead-in wires may come into contact with iron gutters or corrugated iron buildings and distribute an earth fault current.

The opinion of your readers upon the advantage or otherwise of disconnecting a sound installation when a local earth fault current appears to create a high potential between earth and the phase connected to the sound installation would be interesting. A. G. BULLEN.

Liverpool, *December 28th.*

Notes on Water Heaters. By F. D. Parker

THE control of immersion heaters and circulators by three-heat switches in conjunction with thermostats undoubtedly leads to reduced energy consumption. What is still more important from the supply authority's viewpoint is that this method avoids " kicks " due to heavy demands on residential networks, often at inconvenient times.

Considering the relatively low cost of a thermostat, its omission is hardly justifiable even if the heater is to be hand-controlled; it also provides a valuable safety measure. Where the electric heater is employed in conjunction with an existing fuel-fired boiler, the value of installing a thermostat possessing a large differential (even up to 15 deg. F.), is not always fully realised. Such a thermostat permits the fuel-heated boiler, when in commission, to effect the boosting during the day. As the cold-feed inlet to most domestic circulating cylinders is unbaffled, considerable mixing of the water takes place even when small quantities are drawn off; the value of the thermostat differential will, therefore, possess considerable influence on running costs.

Many consumers do not wish their hot-water tanks to be lagged, partly because the heat is required for airing purposes in the surrounding cupboard, and this undoubtedly influences them in favour of hand control. Lack of room does not eliminate the possibility of lagging, as efficient strip lagging, less than ¾ in. thick, is now available. Also the cupboard, instead of the tank, can be lagged with asbestos sheet. A further point in favour of hand control is that the consumption can be definitely limited to any desired figure. Here again, however, the thermostat justifies its installation by switching the heater off when it is forgotten.

Water Heating Tariffs

There is a tendency to state definite rates per kWh at which electric water heating, thermostatic or otherwise, is competitive with other means. The dangers of such a practice cannot be over-estimated. The value of any installation, whether electric cooking, water heating or space heating, is determined purely by its value to the consumer and varies considerably according to circumstances. The specifying of rates per kWh may do incalculable harm when considered by the lay mind, and they may also be abstracted by electricity's competitors and quoted to consumers, and even employed as a basis for a competitive tariff.

I can recall an instance where electricity at over 1d. per kWh proved quite competitive with coal for water heating. The boiler consumed coal to the value of 1s. 3d. per day, the hot-water system involving long runs of pipe work and consequent heat losses. A 3-kW immersion heater inserted in the circulating tank, which was installed near to the draw-off points and operated in conjunction with a three-heat switch and thermostat, required only one hour on full heat and eight hours on low heat to effect the equivalent amount of heating, the cost being approximately 9d. per day.

As domestic water heating is perhaps the most flexible of all domestic loads, it is especially suitable for off-peak working. Provided there is adequate water storage to cater for the maximum demands, allowing generously for heat losses, and that the system is efficiently lagged and the cold-feed inlet to the tank carefully baffled, everything is in favour of thermal-storage water heating in larger houses at low off-peak rates.

The common practice of allowing a boosting period during the day, however, detracts in some measure from the off-peak value, and this practice should be avoided, either by storing at a still higher temperature or boosting by means of a small coal fire.

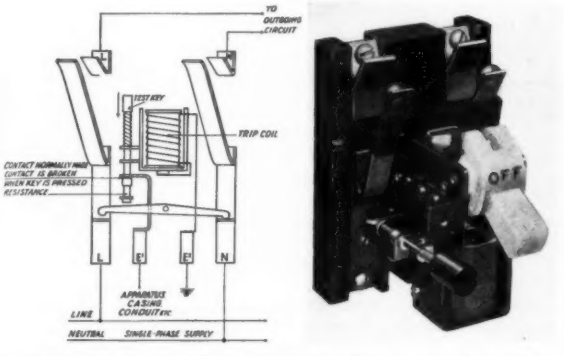
Another form of thermal-storage installation where the smallness of the circulating tank does not permit a definite off-peak installation is represented by an immersion heater having a loading not exceeding 0.3 kW, to which energy is supplied at an annual fixed charge. The kWh consumed per kW installed, especially if the heater were thermostatically controlled, would be high, most of the consumption being during the night and before noon. Such an arrangement would prove adequate for the average small modern house where the pipe runs are relatively short.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Earth-leakage Trip Switches

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4, are responsible for the production of a range of inexpensive low-current leakage-protection switches of small dimensions. The double-pole 30-A



A diagram of the earth-leakage trip switch, and a view of the switch with cover removed

switch is 5¼ in. high, 3 1/16 in. wide, and 3⅞ in. deep, and ample space for cable entry is provided. The general arrangement of the test key can be seen in the left-hand portion of the illustration. All casings are of moulded insulating material so that no question arises of isolating the metal casing from the earth electrode when the test key is pressed. These test keys are fitted to all patterns, and tests can be obtained from both neutral and phase lines. The trip can be set for any value of tripping current between 30 and 60 mA to meet the requirements of cookers with new hot-plates, which sometimes pass as much as 30 mA to earth.

Although Regulation 1005 C simply calls for a leakage trip operating at not more than 30 mA, the real need is the limitation of leakage potentials. Tests show that with an earth-electrode resistance of 200 ohms, the operating voltage is 16.5 V at 30 mA, and 32 V at 60 mA. With 500 ohms these values become 25 V and 48 V. These tests were made with 50 cycles a.c.; on d.c. the operating potentials are much less.

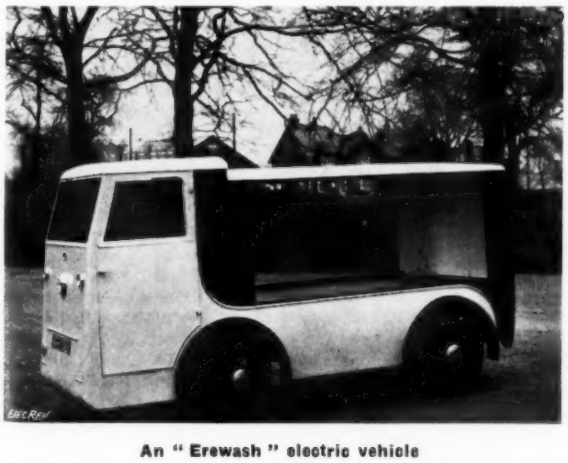
The present available range includes one-, two- and three-pole switches for 30 and 60 mA, but this is to be extended to overload protection in the form of an all-insulated combined earth-leakage switch and fuses, and also a cooker-control panel. Both of these devices will incorporate the standard leakage trip. The cooker-control panel is intended especially for installation in rural areas, where the cooker is often the only metal-clad apparatus in the installation that requires special protection.

"Erewash" Electric Vehicles

Electric vehicles, with a rated payload of 15 cwt. and a normal range of 35 to 40 miles per charge, extended if necessary to 50 miles, are made by the EREWASH ELECTRIC TRACTION CO., 64, Ray Street, Heanor, Notts.

The motor has been designed to give a good performance on hills, and operation is simplified by the use of one foot pedal which gives three speeds from 6 to 18 m.p.h. Semi-elliptic springs are used, and the rear axle is worm driven in a pressed steel case. The 10-in. "Bendix" brakes are both foot and hand controlled, operating on all four wheels.

A pressed-steel frame chassis is used and transmission is through a hollow-steel shaft with universal joints. The D.P.



An "Erewash" electric vehicle

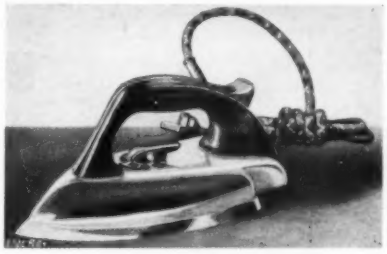
"Kathanode" traction batteries take 18 kWh per charge. The lighting equipment is standard, apart from the fact that there is only one head lamp, and the ampere-hour meter is of the latest type showing the exact condition of the battery; a red indicator gives warning of approaching exhaustion. The charging is automatically controlled.

A Low-voltage Transformer

The latest production by the RAY ENGINEERING CO., LTD., 53, Queen's Square, Bristol, is a low-voltage transformer designed for heavy duty. It is double-wound, totally enclosed for wall fixing, and is made in three sizes (120 W, 300 W, and 700 W).

An Unorthodox Iron

The WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 2, Norfolk Street, Strand, London, W.C.2, announces the introduction of a new "streamline" iron of unorthodox construction and design. It is fitted with a 1,000-W element, controlled by a built-in thermostat. The bakelite finger-tip lever, marked for different fabrics, has a wide temperature range.



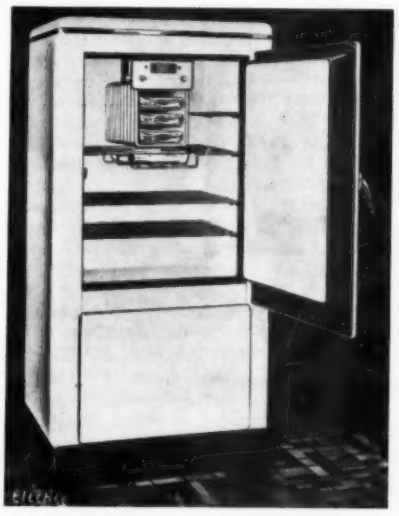
The new Westinghouse iron

The weight is only four pounds, and the one-piece bakelite "fatigue-proof" sloping handle is set off from the cover, insulating it from the heat of the base.

The six-foot cord is permanently attached to the iron handle, made with high quality covering and a durable rubber sleeve to prevent burns.

Domestic Appliances

The recently formed GREENFIELD MACHINERY CORPORATION, LTD., 6, Francis Street, Westminster, London, S.W.1, is now marketing in this country a large number of American goods, including products of the American Steel Export Co., the Simplicity Equipment Co. and the Zerozone Refrigeration Co. Four models of Zerozone refrigerator are available, with gross food storage spaces of 4.9, 5.9, 7.2 and 9.5 cu. ft., the chief features being nine-temperature "Coldial" control, rubber ice-trays of ample capacity, porcelain enamelled cornerless dry expansion type evaporator with a glass tray underneath to collect water during defrosting, flat metal bar shelves, latest design handles and hinges, and a high base facilitating cleaning underneath. The overall dimensions range from 54 in. high, 24 in. wide, and 20 in. deep for the smallest model, to 63 in. high, 33 in. wide and 24 in. deep for the largest. Automatic interior illumination is provided in the larger types. The refrigerating unit is quiet in operation and every model carries a year's guarantee.



The "Zerozone 755" refrigerator with a gross food storage capacity of 7.2 cu. ft.

The "American Beauty" soldering irons also sold by the company are of simple and sturdy design and incorporate many exclusive features. The heating element cores are machined from solid steel rod, the outer surfaces being impregnated with zinc to retard corrosion. The nickel-coated copper tips extend the full length of the nickel-chromium element and are easily removable.

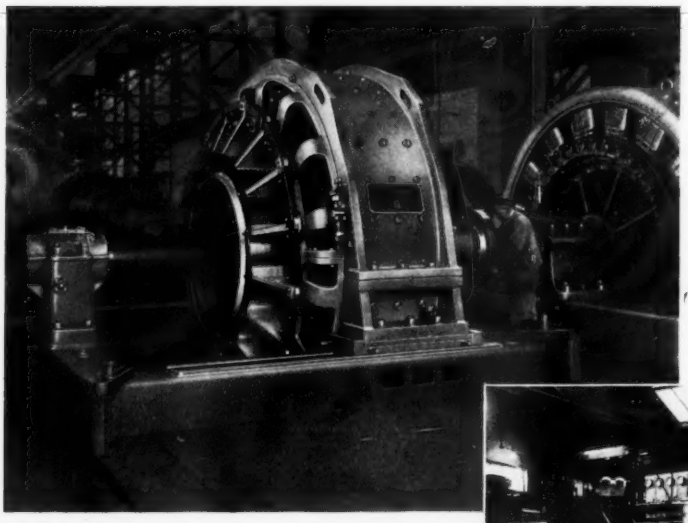
Other appliances stocked include "Star-Rite" hairdressing sets and "X-ylarator" vibratory massage apparatus and garage equipment

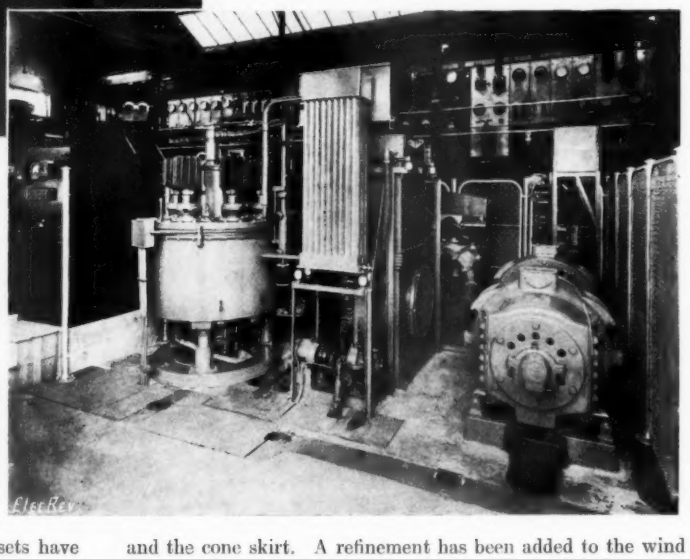
Manufacturers' Activities in 1935

General Electric Co., Ltd.

THE General Electric Co., Ltd., reports that during the past year its various works have been fully occupied with an increased volume of business.

Dealing first with research, a section of the Wembley Laboratories has been equipped for television development, and the production of high-definition cathode-ray tubes has been studied. A departure in cold-cathode discharge tubes has been the coating of the inside of the tubes with luminescent powders which give novel colour effects under the influence of the ultra-violet rays. Street-lighting problems have received special attention and the "Osira" lamp and accessories have been further improved. Radio interference prevention and the production of air-cooled anode valves with outputs of several hundred watts at a wavelength of 3 metres were included in the radio research activities. Another development has been the design of a hotplate with 1,750 W loading in a diameter of $7\frac{1}{16}$ in.





Left: A 2,400-h.p. 550-V, 160-r.p.m. winding motor for South Africa. Right: 1,000-kW mercury-arc rectifier equipment in a Poplar sub-station.

One of the outstanding achievements in engineering plant has been the production of pumpless mercury-arc rectifiers, three of which are being installed for the London Passenger Transport Board. The larger sets in hand include the 62,500-kVA sets for Hams Hall, Birmingham, and machines for Palestine and Johannesburg. Smaller sets have been supplied to many Empire and foreign countries.

The mining plant demand has continued; one equipment was supplied for installation at a depth of 7,000 ft. Winding equipment is being supplied to the International Nickel Co., of Canada, and steelworks plant for a number of home concerns is in hand.

The completion of the Witton high-power testing laboratory enables switchgear to be subjected to short-circuits up to two million kVA at commercial voltages. Switchgear for 11-kV operation is being made for Hams Hall and the London Transport Board, while outdoor oil circuit-breakers of 1,000,000-kVA breaking capacity are being manufactured for Palestine and New Zealand, and others of 750,000-kVA for the Northmet Co.

Colliery switchgear has been further developed, one of the latest products being a flameproof oil circuit-breaker of 25,000-kVA rupturing capacity (440 or 3,300 V). Further progress has also been made in the direction of automatic control of bridges, coal-handling plants, etc. Cartridge fuses rated at 25,000 kVA (up to 600 V) have been introduced.

Trolley-bus and tramway equipments have been ordered from the company by the London Transport Board, Nottingham Corporation and Rotherham Corporation. Marine equipment has been supplied for many vessels under construction. Seven recent ships have been equipped with "plural starter" equipments, each controlling seventeen motors. Equipment for a diesel-electric Thames tug (350 h.p.) is in hand.

Industrial steam plant orders have included sets for paper mills, requiring process steam, turbo blowers and turbo compressors. A new design of impeller has permitted an increased peripheral speed of blowers and compressors, thus reducing the number of stages. Plant for the handling of materials has included a complete coal-handing plant for a large chemical works and another for the power station of the new port of Lunghai, China. The latter includes a wagon tippler for dealing with trucks 45 ft. long and 60 tons gross weight. Several dust-precipitation and coal-washing plants were ordered during the year. A number of Fraser and Chalmers mining plants were exported during 1935, notably a cyanide installation for Spain.

Lighting developments have included a 500-W projector lamp with a $1\frac{1}{4}$-in. dia. bulb, while the range of architectural lamps has been extended. The company was responsible for a number of Jubilee floodlighting schemes. Over 100 new floodlighting equipments based on the use of 250-W line filament horizon type lamps were supplied for use on the Iraq oil pipe line.

During the year an important contract was received for the illumination of the Croydon Aerodrome, while the company is also equipping twelve aerodromes on the Karachi-Rangoon air route. Among the new equipment of this nature introduced is a new boundary light the stem of which is a white cone clearly visible by day. At night the cone is illuminated by light reflected downwards from the single lamp which serves the dual purpose of illuminating the boundary light proper and the cone skirt. A refinement has been added to the wind direction indicator which, when the wind speed is less than three miles per hour, returns the indicator to a predetermined position which can be set to indicate the best landing direction.

Among the cable contracts was one for 50 miles of Pirelli-General oil-filled cable for the Central Electricity Board. At the Coventry telephone works a new automatic telephone selector has been designed which effects considerable economy in rack and floor space. A station completed at Belfast, for Anglo-Irish telephone traffic, has initial equipment for 30 four-wire repeaters.

In conjunction with the Reliance Telephone Co., the company installed automatic vote-recording apparatus in the Middlesex Guildhall. Railway signalling apparatus supplied included train-describer equipment for the South African Railways, and nine large groups of traffic signals were installed in London by the Siemens and General Electric Railway Signal Co.

A 20-kW, 60 lb. per hour, electrode boiler has been introduced for sterilising purposes on farms and in dairies.

Many furnaces, some of special types, have been supplied. One development of the Grunevald process has been in connection with the annealing of high-carbon steel without decarbonisation. A modification of the process has been applied to the bright annealing of copper sheets. A range of five furnaces for the surface hardening of special steels and irons by the ".Nitralloy" process is now available.

In the industrial cooking field a development has been the adoption of the "Marine" type hob for all cooking ranges and boiling tables. This hob protects the leads and connections to the hotplate from spilt fats, swillings, &c., and is totally enclosed.

Progress in domestic cookers has been largely concerned with the thermal-storage type. Two new models have been evolved—an "all-storage" cooker which performs all cooking operations by means of stored heat and a "semi-storage" type which uses stored heat for hob cooking only. The standard range has been added to and efficiency has been improved by the increased loading of hotplates.

The design of the company's radio receivers has been improved and one new departure is a car radio equipment with a wide range. The range of receiving cells has been extended. A new design of photo-cell amplifier has a wide general application and an equipment of more limited scope has been evolved for switching artificial lighting on and off as darkness approaches or recedes.

There has also been a great deal of activity in the production of installation accessories. The permission given by the new I.E.E. Regulations for a maximum of ten points to be connected to a final sub-circuit has led to the design of special components to meet the demand for 2-A socket outlets and plugs in both two- and three-pin patterns.

English Electric Co., Ltd.

NUMEROUS orders for turbo-alternator sets up to 30,000 kW capacity were placed with the English Electric Co., Ltd., during 1935. A large number of the turbines were of the back-pressure type for industrial work at pressures up to 650 lb. per sq. in., and in two cases for superimposing high-pressure sets in existing power stations, the exhaust steam being utilised in the existing low-pressure plant.

Electric winding equipments both of the a.c. and Ward-Leonard types, ranging from 300 to 3,500 h.p. peak loads, were despatched to Canada, South Africa, West Africa, New Zealand, India, and South America, practically all the a.c. equipments being fitted with the company's special device which limits the period of acceleration to a pre-determined value. On Ward-Leonard winders a displaced compensated winding is provided on the generator, with a greatly improved electrical braking device.

In the steel industry large drives for special continuous rod mill equipments created records for outputs and low-consumption figures. The company has under construction two equipments of 17,000 h.p. and 20,000 h.p. (peak) for South Africa (a repeat order) and South Wales respectively.

Early in 1935 the first stage of the Galloway Water Power Company's hydro-electric scheme was put into commission, and progress has been made in the manufacture and installation of the plant for the second stage of this scheme; two stations of the latter scheme will be capable of running completely unattended. Orders were received for three horizontal shaft overhung twin reaction turbines, each of 18,000 h.p. under a maximum head of 160 ft.; two 620 h.p. reaction turbines and alternators; an 8,140-kVA water-wheel driven alternator; and the company's cylindrical balanced streamline discharge regulator.

Two 300 h.p. diesel generating sets in the British pavilion at the Universal and International Exhibition, Brussels, were awarded a *grand prix* in three classes (industrial combustion engines, industrial production of electricity, and electro-mechanics). Other contracts for this type of plant included four 875 b.h.p. diesel engine alternator sets with switchgear, transformers, and all accessories; seven diesel generating sets aggregating approximately 8,500 h.p.; and sets for South Africa, the Gold Coast, Malay States, India, Australia and Christmas Island apart from home orders.

During the year the diesel-electric tug, *Framfield*, and the diesel-electric paddle vessel, *Talisman*, were put into service, and equipment has also been supplied for electrically operated tin and other dredgers.

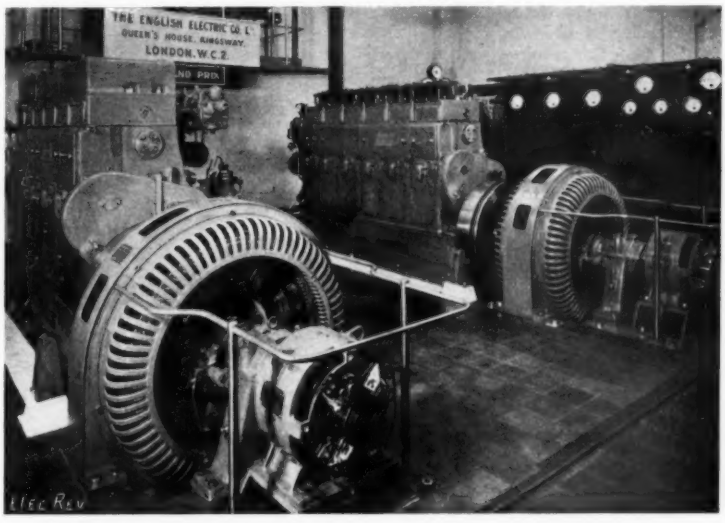
The Dynamo and Motor Department's contracts included a large number of variable speed a.c. commutator motors for the Dunlop cotton mills, the electrification of a jute mill in India, and a brick works and cement works in England. In conjunction with the Whessoe Foundry & Engineering Co., the company has in hand high-voltage motor generator sets for use with electrostatic precipitation plant and high-voltage d.c. generators for an experimental television station.

Large Transformers

A feature of the year has been the large increase in the use of a.c. arc-welding equipments incorporating transformers and welding regulators. For the first time reactors for service directly in 132 kV systems are being built. They are made as single-phase units and are oil-immersed; they will give 10 per cent. reactance on 50,000 kVA at 132 kV. Large transformers with on-load tap changing gear have been supplied for service at 33, 66, 80, and 132 kV. Three 55,000-kVA banks of transformers for service at 80 kV with on-load tap changing gear on the 80-kV side have windings fully insulated for test at 180 kV. Since the 80-kV system is fully insulated, whereas the 132-kV system operates with the neutral solidly earthed and the tap-changing gear located in the circuit toward the neutral end, it is probable that this tap-changing gear operates at a higher voltage than any so far built in this country. Transformers totalling 45,000 kVA are in course of construction for the Central Electricity Board, which has also ordered one new switching station and the extension of two 132-kV stations.

The range of metal-clad fuse gear, distribution boards, "Combination" fuse switches, and heavy-duty service cut-outs has been added to, and an important development has been the use of the high rupturing capacity fuse for the back-up protection of both low- and high-voltage circuit-breakers which are now operating under heavier conditions than those for which they were originally installed.

In the field of traction the extension contract for the Copenhagen suburban electrification of the Danish State Railways



The English Electric generating plant at the Brussels Exhibition

was successfully put into operation during the summer. Shunting locomotives of the 350 h.p. diesel-electric type have been built or are under construction for the L.M.S., the G.W.R., the Sudan Government Railways, and the New Consolidated Gold Fields, Johannesburg. Trolley-buses have been supplied, either complete vehicles or electrical equipments, in considerable numbers to municipalities both at home and overseas.

New English Electric domestic appliances include electric irons, the "Handidrier" and washing machines, and contracts have been secured for "inset" fires in several new housing estates. The meter department is now in full production, and a large proportion of the meters sold during the year were of the "all insulated" type.

Automatic Door Opening

A LIGHT-sensitive device recently installed at Redhill railway station, which is said to be the first of its kind to be employed in a sorting office, operates two pairs of double doors to a lobby giving access to the Southern Railway Co.'s new subway and lifts. Light rays are projected from lamps in the ceiling on to selenium cells, housed in cast-iron boxes with glass windows set in the floor. A person or truck leaving the beam causes the doors to open and to reclose after an adjustable time period. The second pair of doors opens as the first closes, thus avoiding draughts into the office. Spring switches hold the door open, if required, when the current is off. Each equipment includes two selenium cells, with an amplifier in conjunction with relays that control the electric motor. The latter rotates a cam through 300 deg. to move levers which open the door against the pressure of springs. When the door is fully opened a limit switch cuts off the current and applies a brake. Rotation of the cam through a further 60 deg. closes the door. The installation was carried out for the Office of Works by Automatic Electrical & Mechanical Controls, Ltd.

Giants in the Brickmaking Industry

THE London Brick Company & Forders, Ltd., one of the largest firms of brickmakers in the world, have an annual output of 1,500 million bricks. To achieve such figures machines somewhat out of the ordinary have to be used. For example, five million tons of raw material have to be excavated every year, requiring the use of forty-eight mechanical excavators. The claypit (or "knothole," as it is called locally) belonging to the Stewartby works, near Bedford, which is the company's largest individual unit, has an output of ten million bricks weekly and requires the use of abnormally large excavating machinery.

A double cantilever type conveyor, 300 ft. long, which was put into commission early in 1933, was built by Robert Boby, Ltd., to the designs of the brick company's own engineers. It is 295 ft. between the centres of the pulleys, and its rubber and canvas belt is 48 in. wide with a speed of 100 ft. per minute, driven by a 25-h.p. slip-ring induction motor. The double cantilever which carries the belt is pivoted on two journal bearings 8 in. in diameter by 12 in., which take the whole weight of the 103-ton superstructure. These cantilevers can be tilted 12 deg. above and below horizontal about the bearings by means of a large horizontal screw working in a cross-head and driven by a 25-h.p. slip-ring motor. The 300-ton conveyor is carried on four four-wheel bogies running on two tracks 46 ft. 6 in. centres apart. Each bogie has its own 9.2 h.p., d.c. motor supplied from a motor-generator set in the control cabin and operating on the Ward-Leonard system, with a special field control. This method enables the outer bogies to run faster than the inner ones when travelling around curves, and the structure is thus relieved of unnecessary stress.

General view of the Stewartby works of the London Brick Co. and Forders, Ltd., with Henley "Supertuff" cable in the foreground

This giant machine removes the overburden of callow from the brick earth deposit and dumps it back into the worked-out pit, the overburden having been previously dug by a Ruston dragline excavator on caterpillar tracks. Working on the original ground level, the excavator digs out the callow and dumps it on to a short conveyor, which takes its supply from the 300-ft. conveyor. The short conveyor, which has a length of 100 ft. and is belt-driven by a 15-h.p. slip-ring motor, is interlocked so that it cannot be started unless the larger conveyor is operating. Of single cantilever construction, it travels on rails, and it can be slewed in any direction to discharge its load on the 300-ft. conveyor.

The giant "navvy," which is engaged in digging the brick earth, was built by Ruston Bucyrus, Ltd., and has been in commission for six years, during which time it has excavated about 80 acres of land, the working face averaging 60 ft. The total weight of the machine is 300 tons, the bucket alone weighing 13 tons, and having a capacity of 10 cu. yds. The navvy is electrically driven throughout, and is equipped with Ward-Leonard control for the hoisting, racking and slewing motions. The winding drum is driven by two 160-h.p. d.c. motors in tandem, a 200-h.p. motor is used for slewing the superstructure, and the bucket arms are racked in and out by means of a 130-h.p. motor mounted half way up the jib. These motors are supplied from a five-unit motor generator set mounted transversely at the back of the cabin, and driven by a 350-kVA synchronous motor operating at 0.8 leading power factor at full load.

The supply to the navvy is at 400 V, 3-phase, 50 cycles, from a transformer. A length of 300 yards of Henley 6,600-V three-core flexible "Supertuff" trailing cable (0.03 sq. in. 117/0.018) connects the "navvy" transformer to the Bedford Corporation mains. The cable is laid on the open ground, and is subject to very severe treatment. It is composed of three circular cores, wound together and covered with a c.t.s. sheath, over which is a layer of flexible steel wire armouring, the whole being sheathed finally with "Supertuff" rubber sheathing. The 300-ft. conveyor is supplied by a 750-yd. length of "Supertuff" four-core 400-V cable (0.1 sq. in. 160/0.029); and between the conveyors is used "Supertuff" 400-V cable, with three main cores (0.06 sq. in. 248/0.018) and two pilot cores (0.007 sq. in. 65/0.012).

New Books

Communication Networks (Vol. II). By E. A. GUILLEMIN. Pp. 587; figs. 233. London: Chapman & Hall, Ltd. Price 37s. 6d.

During the last ten years there has been much research in the mathematical theory of electrical networks, and in the work under review the author has incorporated the results of this research in an advanced treatise in which the theory of long lines, filters, and related networks is presented from the point of view of communication circuits. The author's treatment is lucid, whilst being exhaustive, and his work is essentially one dealing with a branch of applied mathematics rather than with engineering practice. The book, nevertheless, has been written for engineers, and the mathematical treatment, whilst involving advanced analysis, is as simple as possible.

The first section of the book deals with the long-line problem, the solution of steady-state equations, and with long-line characteristics. The author then follows on with the treatment of four terminal networks and with problems arising therefrom. In this section the use of matrices in mathematical analysis is explained, and their application to network problems is demonstrated. A considerable amount of space is devoted to the theory of filters and their design and behaviour in transient conditions.

The final chapter deals with the transient behaviour of long lines. There is an extensive selection of problems for solution by the student, but, as is customary in American text-books, no answers to the numerical examples or hints for the demonstration of theoretical problems are given. A comprehensive list of symbols is given in an appendix, whilst there are numerous references to original papers in the form of footnotes. The illustrations are numerous for a mathematical work, and are exceptionally good. Dr. Guillemin's treatise will be found most useful by engineers of good mathematical attainments who desire an up-to-date and exhaustive theoretical presentation.

Alternating-Current Machinery. By J. M. BRYANT and E. W. JOHNSON. Pp. 790; figs. 541. London: McGraw-Hill Publishing Co., Ltd. Price 36s.

The authors are the professor and associate professor of electrical engineering in the University of Minnesota, and their book is intended for electrical-engineering students.

In the preface we are told that the fractional-slot armature winding has almost entirely displaced the integral-slot winding in synchronous machines, but in the text the information given is not much in advance of the methods used a generation ago in English design offices. Nor is the bibliography on this subject by any means complete—no mention being made of classic papers on the theory of windings in the *Journal* of the Institution of Electrical Engineers.

If these fractional windings are becoming universal the involved earlier methods might be replaced by scientific methods now available. As in most American books, photographs are widely used, but some of these are far from excellent. Thus, figs. 10 and 13 on shell-type transformers will leave a student rather bewildered. Otherwise, the chapters on transformers are well done—the treatment is full and extends over 334 pages, or nearly one-half of the book. In

addition to a few worked examples, there are numerous problems without numerical answers. Strangely enough, little is said about additional losses in copper and means for reducing them. The chapters on transformer connections, including auto-transformers, are both ample and satisfactory in their arrangement.

Passing on to synchronous machines, there are fourteen chapters which cover the subject fairly well. Here, too, the photographs are the least satisfactory part, but there is little in the way of padding to complain of. Both the synchronous and m.m.f. methods of determination regulation are discussed, but we do not find much on the calculation of reactance. Also, in the discussion of slot harmonics, the reader is not told that their distribution coefficient is equal to that of the fundamental. In the analysis of m.m.f. waves rectangles are assumed. It is nearer the truth and simpler to take trapezia, which, applied to the general case, show that the amplitude of the harmonics decrease as the square and not directly as their order.

The last 200 pages cover a number of subjects—single- and polyphase induction motors, induction generators, convertors, frequency changers, a.c. commutator motors, and mercury-arc rectifiers.

This book is much more thorough than many American textbooks on electrical machinery. The treatment is analytical and generally up to date. Purely descriptive matter is kept within reasonable bounds. In many ways, we should imagine that parts of the treatment will appeal more to specialists than to students.

Fraudes en los Contadores Electricos. By Manuel G. Y. Freixas. (257 pp., illus.) Barcelona: Publicaciones Tecnicas, M.G. Price 7 pesetas.

Thefts of electricity are not a common feature in this country—discovered thefts, that is—but one would judge that they are sufficiently prevalent in Spain to justify the publication of a manual on the subject.

In this work the matter is considered from both the legal and technical aspects. The first part is devoted to an explanation of electrical terms and descriptions of electricity meters, their installation and maintenance. Then follow some details of the methods which have been employed by electricity thieves and the ways in which electricity supply authorities have endeavoured to combat these. The last part deals with the law of the subject and penalties imposed by different countries.

The author has gone to considerable pains to produce a complete survey of a somewhat unusual nature, but his book should be kept out of the hands of the unscrupulous.

Technical Data on Fuel. Edited by H. M. SPIERS. Pp. 374; figs. 66. London: British National Committee of the World Power Conference. Price: 12s. 6d.

A call for four editions of this work in seven years justifies the expectations of its utility which we expressed when reviewing the first edition in 1928. Since then the text has been expanded by 70 pages and a number of blank pages are included, as before, to take the user's own memoranda. Among the new material is information on the resistance of thermocouples, the velocity of flame propagation in mixtures of pulverised coal and air and heat loss from surfaces, all hitherto unpublished. The pulverised fuel section has been completed, revised and extended. International Steam Tables are presented in the revised form (October, 1935). The membership of the editorial committee has been enlarged and authoritatively represents all branches of fuel technology.

* * *

Shorter Notices

"Engineering Economics—Book 2—Works Organisation and Management," by T. H. Burnham. Pp. 312; figs. 61. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d.—This is the third edition of a substantial work, which is designed to give a knowledge of the fundamentals of works organisation and management to those taking Section C of the A.M.I.Mech.E. examination and the examinations of the Institute of Production Engineers. It covers such matters as the management function; personnel policy and wages payment; design and administration; the control of quality, progress, purchasing and materials; factory lay-out and factory costing. The book should serve its intended purpose admirably.

"Training in Industry," by R. W. Ferguson (Sir Isaac Pitman & Sons, Ltd. Price 6s. net).—This is a report based on the results of inquiries conducted by the Association for Education in Industry and Commerce during the past three years, and it should prove of interest to those engaged in educational work in industry and commerce, and to those in executive positions. Detailed descriptions are given of the training and educational schemes of some of the leading concerns in this country.

"Private House Electric Lighting," by F. H. Taylor. Pp. 123; figs. 95. London: P. Marshall & Co., Ltd. Price 1s. 6d.

Argentine Electrical Imports in 1934

British share well maintained

THE Argentine Government has issued its annual statement for 1934 of the foreign trade of the Republic showing the principal participating countries. From this the following figures, showing the values in thousands of gold pesos (peso=4s.), according to the valuation of the Argentine Customs Department, of electrical imports in 1934 have been extracted. A note of increases or decreases compared with 1933 has been added.

It will be seen from the figures that the United Kingdom has well maintained its share of the trade generally, and in the cable group increased it in underground descriptions and particularly in other kinds.

	1934. Pesos (Thous.).	Inc. or Dec. Pesos (Thous.).
Accumulators and cells—		
Total	1,475	+ 87
From Germany	157	+ 11
„ Canada	150	+ 37
„ United States	990	+ 210
„ United Kingdom	104	− 174
Batteries—		
Total	963	+ 231
From Germany	24	+ 2
„ United Kingdom	47	− 6
„ Denmark	102	+ 5
„ United States	787	+ 232
Ammeters and voltmeters—		
Total	76	+ 9
From Germany	26	+ 3
„ United States	22	− 4
„ United Kingdom	16	+ 9
Radio-telephone apparatus—		
Total	1,393	− 377
From Germany	252	+ 10
„ United States	1,052	− 238
„ Holland	28	− 48
„ United Kingdom	57	+ 26
Receiving sets—		
Total	2,961	+ 244
From Germany	38	− 25
„ United States	2,564	+ 578
„ Hungary	76	− 180
„ Holland	251	− 104
„ United Kingdom	28	− 3
Loud speakers—		
Total	37	− 9
From United States	31	+ 6
„ Holland	3	− 14
Radio-telephone parts—		
Total	2,721	+ 347
From Germany	246	+ 31
„ United States	1,920	+ 6
„ Holland	212	+ 143
„ United Kingdom	249	+ 168
Telephones—		
Total	351	+ 178
From Germany	16	− 14
„ Belgium	13	− 21
„ United States	6	− 13
„ United Kingdom	3	− 77

	1934. Pesos (Thous.).	Inc. or Dec. Pesos (Thous.).
Telephone materials—		
Total	192	+ 61
From Germany	4	− 82
„ United Kingdom	54	+ 35
„ United States	32	+ 23
Telegraph materials—		
Total	28	− 14
From United Kingdom	22	− 17
Circuit breakers, switches, fuses, sockets, etc.—		
Total	1,062	+ 29
From Germany	650	+ 34
„ United States	140	− 45
„ Italy	119	+ 5
„ United Kingdom	53	+ 20
„ Belgium	57	+ 29
Insulating tape—		
Total	333	− 52
From Germany	33	− 20
„ United Kingdom	75	− 17
„ United States	128	− 49
„ Japan	58	+ 2
Incandescent lamps—		
Total	2,054	− 177
From Germany	228	− 58
„ United States	95	− 21
„ Japan	473	− 530
„ Holland	447	− 43
„ United Kingdom	174	—
House service meters—		
Total	1,100	− 2,353
From Germany	475	− 1,766
„ United States	402	− 67
„ France	7	− 211
„ Austria	83	− 342
Insulating tubes—		
Total	694	− 80
From Germany	490	− 72
„ United States	38	− 47
„ United Kingdom	136	+ 24
Electrical materials, unspecified—		
Total	1,956	+ 296
From Germany	645	+ 35
„ United States	626	+ 445
„ Italy	168	+ 3

	1934. Pesos (Thous.).	Inc. or Dec. Pesos (Thous.).
Electrical materials, unspecified—continued		
From United Kingdom	147	+ 28
„ Sweden	83	− 25
„ Switzerland	117	+ 55
Motors and dynamos—		
Total	1,221	− 225
From Germany	332	+ 4
„ United States	119	− 226
„ United Kingdom	199	− 76
„ Sweden	345	+ 77
Fan motors—		
Total	128	+ 8
From Germany	49	+ 33
„ United States	48	− 17
„ Italy	21	− 6
„ United Kingdom	1	− 11
„ Japan	8	+ 8
Electric cables—		
Total	4,071	+ 1,977
From Germany	1,218	+ 542
„ United States	423	+ 5
„ United Kingdom	1,812	+ 1,109
Underground cables—		
Total	3,930	− 72
From Sweden	69	− 172
„ Germany	3,030	− 373
„ Italy	140	+ 125
„ United Kingdom	445	+ 396
„ Holland	243	− 38
Telephone cables of iron or steel covered with cotton, rubber, etc.—		
Total	323	+ 166
From Canada	161	+ 103
„ United States	2	− 42
„ Norway	159	+ 104
Accessories for underground cables—		
Total	195	+ 115
From Germany	63	+ 45
„ United Kingdom	124	+ 79
Flex—		
Total	272	+ 99
From Germany	24	− 4
„ United States	39	− 3
„ United Kingdom	186	+ 98

Business and Industrial Notes

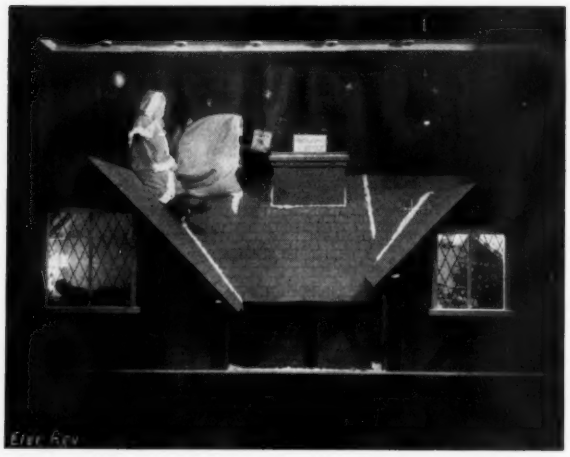
The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

A Canadian National Exhibition

The Department of Overseas Trade informs us that Mr. A. M. Wiseman, M.C., H.M. Trade Commissioner in Toronto, will attend at the Department, 35, Old Queen Street, Westminster, S.W.1, for the first half of January for the purpose of giving his advice to United Kingdom firms who may wish to consider exhibiting their products at the Canadian National Exhibition this year. This exhibition, which has been held annually for the past fifty-six years and lasts for a period of fourteen days, at the end of August and the beginning of September, is housed in permanent buildings of its own and for a number of years past has been international in scope. There are about one and a half million visitors to the Exhibition each year. A British (United Kingdom) Section of the Exhibition was organised some years ago, and this has become a popular feature. For the past two years responsibility for the organisation of this section has been undertaken by the British Trade Branch of the Toronto Board of Trade (*i.e.*, Chamber of Commerce), and notable reductions have been effected in the cost of space. This section is already supported by a number of important United Kingdom manufacturers. Applications for interviews with Mr. Wiseman should be addressed to the Department, quoting reference number 20966/35.

A Christmas Display

The accompanying illustration shows a recent window display in the showrooms of the Woking Electric Supply Co., Ltd. It depicts electrical presents coming out of Santa Claus's



A Christmas display by the Woking Electric Supply Co., Ltd.

sack and moving down into the chimney, following upon cards which appear out of the chimney stating that "Mother wants a Kettle," "Father wants a Toaster," and so on. The interior of the house was appropriately fitted with electrical apparatus.

Cable Works Extension

The London County Council has consented to Standard Telephones & Cables, Ltd., erecting a new factory building, of a greater height than prescribed by the London Building Act, 1930, on the western side of Henley Road, North Woolwich.

M.-V. Employés' Benefit Funds

A general review of the employés' benefit schemes associated with the Metropolitan-Vickers Electrical Co., Ltd., has disclosed that the present accumulated funds total over £500,000. This amount has been accumulated during the past fourteen years by approximately 13,000 employés, and is made up by works and staff benevolent funds, a male staff pension and life assurance scheme, a female staff benefit scheme, and a thrift scheme which in effect is a savings bank open to all employés domiciled in the British Isles. Practically all the schemes are supplemented by contributions made by the company.

American G.E. Drops Unemployment Benefit

The *Electrical World* reports that with the advent of federally administered "social security" on January 1st, the General Electric Co. was to terminate its unemployment compensation plan. Since the fund's inception in 1930, employés and the company have paid in more than $7,000,000 to care for workers. About $3,000,000 of the fund remains, while loans totalling approximately $800,000 have been made and $500,000 repaid, indicating unemployment benefits of $3,700,000. Of the balance on hand, $1,750,000 is in the local works fund, with three plans offered for its disposition; namely, to distribute about $20 each to 45,000 employés; to end payments on December 31st, but continue benefits as long as the money lasts; or to end payments but allow the fund to be used as part of the proposed relief and loan plan. The other $1,250,000, in the general fund, cannot be returned, but will be applied to "purposes beneficial to the employés," perhaps divided among the various groups proportionately for the new relief and loan plan. The company also is restoring holidays with pay for hourly workers this year. The Lynn, Mass., plant has increased working hours from 36 to 40 a week.

"Official Notices"

Readers who are accustomed to studying the "Official Notices" in our advertisement pages will find that these have been rearranged for their convenience. The notices inviting tenders for plant, &c., are placed first in the section and these are followed by the advertisements of situations vacant and classified advertisements in the usual order.

New Electricity Showrooms

The South-East Kent Electric Power Co., Ltd., has opened new showrooms in Queen Street, Deal. It is intended also to serve the outlying districts, and prospective consumers in the rural area are brought into Deal by the company's representatives.

The Canadian Electrical Industry

The *Board of Trade Journal* has published figures showing the total Canadian output (regardless of the industries in which they were produced) of certain commodities and equipment in the electrical apparatus and supplies industry in 1934. This industrial group includes most of the concerns in Canada which manufacture equipment for use in the generation, transmission, and utilisation of electricity, and the production last year was valued at $50,234,811 as compared with $37,012,509 in 1933, an improvement of 36 per cent. In addition to the production in the electrical apparatus and supplied industry proper, production of these goods was also undertaken by firms in other industries to the extent of $13,587,204. The following figures show the total Canadian output:—

	$
Transformers of all types	2,249,334
Generators and motors (including double current generators and starting motors)	3,672,265
Electric vacuum cleaners and parts	1,549,908
Electric batteries (storage and dry cell)	4,784,944
Domestic washing machines (electric)	3,607,088
Electric refrigerators	3,933,022
Stoves, all kinds	6,521,913
Brass and copper wire and cable	7,628,822
Electric lighting fixtures	995,419
Wireless receiving sets	8,196,248
Incandescent lamps	4,531,935

The total cost at works of the materials used in the main industry producing goods to the value of $50,234,811 was $21,308,006.

Social Events

There was a record attendance of 120 from all departments of the Lancashire Electric Power Co. at the head office fifth annual dinner, presided over by Mr. S. M. Rix, secretary, in Manchester on December 19th. Mr. M. H. Adams, generation engineer, proposed the toast of the company, coupled with the name of Mr. C. D. Taite, and Mr. Rix, in the absence of Mr. Taite, responded, commenting on the rapid progress which had been made during the current year. A smoking concert followed the dinner, and votes of thanks were passed to the artists, who included members of the L.E.P. staff, and to Mr. H. Thomas, the organiser of the function.

The second annual whist drive and dance of Holland House Electric Co., Ltd., was held in Glasgow, on December 18th, over 150 members of the staff and guests attending. During the evening Mrs. Watson presented the prizes to the successful winners at whist, and Mr. Watson replied on behalf of the directors. Thanks are due to Mr. Dunnet, the M.C., and members of the committee, for arranging a successful function.

The social section of the Blackburn Corporation electricity undertaking made a new departure, on December 21st, when the children of the electrical employés were entertained at the Public Hall. After tea each child received presents from Santa Claus, who stripped a giant Christmas tree on the platform. Mr. R. H. Harral, the engineer and manager, Mrs. Harral, and Mr. A. Latham, the deputy engineer, attended, and Mr. R. Wardley, the social secretary, was in charge of the arrangements.

The Tecalemit Sports and Social Club held its annual Christmas dance at the "Q" Pavilion, Kew Green, on December 20th. The function was attended by over two hundred members of the Tecalemit office and works staff. Among those present were Mr. R. A. Chalmers, managing director and Mrs. Chalmers, and the chief executives of the various departments of the company.

The annual party and entertainment given to the children of Tecalemit employés by Mrs. R. A. Chalmers took place in the works canteen on December 28th. Nearly two hundred

children were present, together with a number of relatives. A miniature stage supplied by the Springvale Standfitting Co., was erected at one end and formed the background for an excellent marionette show given by professional entertainers engaged by Mr. W. J. Parslow, general manager. Messrs. Brooker and King-Clifford gave a film display of "Mickey Mouse" and Charlie Chaplin pictures. Subsequently Santa Claus, in the person of Mr. C. B. Brudenell, caused a trap-door in the ceiling to discharge sacks of parcels, which were distributed. The stage-managing and general organisation of the party was handled by Mr. Viner, and the electrical effects and spotlights by Mr. Singleton.

About 200 employés of the Osram-G.E.C. glass works, Wembley, assembled on December 21st at the Clarendon Restaurant, Hammersmith Broadway, for their annual dinner. Among their guests were the managing director, Mr. C. Wilson, Mr. G. Chelioti (Osram-G.E.C. Lamp Works), Mr. E. R. Gant (Marconi-Osram Valve Works), Mr. H. C. Wilson (G.E.C.), and Captain C. Higgins (Claude-General Neon Lights, Ltd.). Mr. C. Wilson, in responding to the toast of "The General Electric Co., Ltd.," expressed his gratification at the rise of the glass works from the position of a Cinderella in the company to that of one of its brightest spots. Dancing occupied the rest of the evening.

Water Screen Contract

Messrs. F. W. Brackett & Co., Ltd., have been awarded the contract for the supply of a circulating water screen, together with accessories, for the Southampton Corporation. The screen will be of the company's latest "central flow" type, incorporating various patented features, and will have a capacity of 1,750,000 gal. per hour at the lowest water level.

Industrial Law

In view of the success of its recent course of lectures on industrial law, the Industrial Welfare Society is again arranging a similar course to be held weekly on Wednesdays from January 22nd next, at the headquarters of the Society, 14, Hobart Place, Westminster, S.W.1. The lecturer will again be Mr. H. Samuels, M.A., Barrister-at-Law. The course is intended for all persons engaged in administrative work in industry and commerce, as well as for persons intending to take up such posts. A detailed syllabus and further particulars can be obtained on application to the Secretary of the Society.

A Railway Finance Company

The Railway Finance Corporation, Ltd., has been registered as a public company with an authorised share capital of £100 in £1 shares. The borrowing powers of the directors are limited to £26,500,000. The objects of the Corporation are to finance the Great Western, the London, Midland and Scottish, the London and North Eastern, and the Southern Railways, or any other transport undertaking in any manner which may from time to time be approved by the Treasury. The first directors are Mr. Walter K. Whigham, Mr. C. J. Hambro, Sir Josiah Stamp, Mr. E. Holland-Martin, and Mr. K. O. Peppiatt. Messrs. Whigham, Holland-Martin and Peppiatt are directors of the London Electric Transport Finance Corporation, Ltd., which was formed in July last on very similar

The new show window which has been constructed in the front of the premises of the Notting Hill Electric Lighting Co., Ltd., at Notting Hill Gate

lines. The registered office of the Corporation is 5, London Wall Buildings, E.C.

The U.S. Public Utilities Bill

The New York correspondent of the *Morning Post* reports that Mr. H. C. Hopson who, as the head of the Associated Gas & Electric System, was one of the important figures in the attempt to block the passage of the Public Utilities Bill last Congress, has been notified that he is $1,521,604 behind in his personal income taxes. This action by the collector of revenue at Newark, N.J., coincided with the demand for $3,898,058 from one of Mr. Hopson's New Jersey companies. It follows only four days from the filing of tax liens totalling $51,000,000 by the New York revenue collector against the Associated Gas & Electric System. This has brought into the open talk about punitive action by the Administration against those who had fought the "death sentence" clause in the Public Utilities Bill.

Technical Humour

Messrs. Ferguson, Pailin, Ltd., have sent us two booklets of humorous drawings. One, entitled "Sauce for the Goose" gives conclusions drawn from a visit to the plant of a switchgear testing company, and the other, "Technical Terms," is a layman's responses to terms in common use, from which the accompanying illustration is reproduced.

Tap Changing on Load

Lamp Manufacture in Ireland

A works with an initial production of 3,000 electric lamps per day was opened on December 19th at Corke Abbey, Little Bray, Irish Free State, by Mr. Sean Lemass, Minister for Industry and Commerce. According to the *Irish Press* Mr. David Frame, the chairman of Solus Teoranta, the owners of the factory, stated at the opening ceremony that the production would shortly reach 5,000 lamps per day and early in January the manufacture of automobile bulbs would be commenced. Mr. Frame said that the factory was entirely self-contained, even the glass envelopes and the gas for filling the lamps being produced there. Another director of the company stated that "the home market could be secured only by definite prohibition of foreign imports and that could be done without inflicting any injury on the consumer or on the electrical industry."

Trade Announcements

The English Steel Corporation, Ltd., informs us that it is reopening the works of its subsidiary company, the Darlington Forge, Ltd., and a start will be made immediately with the work necessary to put the plant and equipment in an efficient state.

Mr. A. E. Webster, founder and late principal of the London Electrical Co., is now trading as the Electric Supplies Co., 37, Walbrook, E.C.4.

Mr. G. Webber is opening premises at 171, Union Street, Torquay, as an electrical and radio engineer, and asks for catalogues.

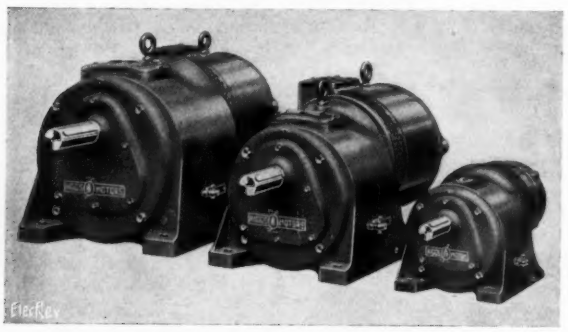
Catalogues Wanted

Messrs. Parlane & Co., manufacturers' representatives, etc., Room 510, 368, Kiangse Road, Shanghai, ask for manufacturers' catalogues and advertising matter.

Motorised Gear Units

A little over twelve months ago Messrs. Higgs Motors, Ltd., designed and put on the market a reduction gear unit for use with their motors. This gear unit was designed to give a maximum output of approximately 1 h.p. at 1,425 r.p.m. reduced to 50 r.p.m. Owing to the success of the original design the range of these units has now been extended up to a maximum of 10 h.p. at 100 r.p.m., or to give a lower final speed with a corresponding reduction in horse-power. These larger units are of similar construction and follow the design of the smaller type. All gear wheels, excepting one in the first (high speed) reduction, are made from special quality high-carbon steel. The exception is manufactured from best quality composition fabric and the use of this type of material in the high-speed gear wheel and the fact that all wheels are generated on Fellowes gear shapers results in an efficient and commercially silent unit. The units have several unique features, the most important being that the body casting is in one piece and there are no joints between the feet, thus eliminating distortion due to unequal bolting down with consequent oil leakage and other defects. All gear wheels, with the exception of the first reduction, run between deep groove ball bearings which are carried in a special cast-iron cage. This cage is machined independently of the main body casting and the result is accuracy in gear alignment and consequently silent operation. On all sizes an oil level tap and drain plug is provided, and on the larger sizes there is an inspection cover. Oil flingers are fitted and all joints are carefully made, making these units definitely tight. They are supplied suitable for mounting on floor, wall or ceiling, but it is necessary to specify

which type is required in order that oil taps may be fitted in the most convenient position. The motor and final shafts are concentric so that the motor shaft can conveniently be extended allowing for two alternative speeds from one unit. The efficiency of these units is very high, the approximate figures being 96 per cent. for double reduction and 94 per cent. for



Higgs motorised gear units

triple reduction units. In view of this high efficiency it is hardly necessary to increase the horse-power of the motors in order to compensate for losses in the gears.

The Johannesburg Totalisator

What is claimed to be the finest totalisator in Africa has just been installed at the Turffontein racecourse, Johannesburg. The installation was carried out by the Johannesburg branch of Siemens Brothers & Co., Ltd., of London. The indicator board is 44-ft. square, with digits 12-in. high and 8-in. wide. To guard against a power breakdown the building contains a battery of sufficient capacity to run the machine for a whole meeting.

The Escher Wyss Company

According to the *Moniteur des Interets Materiels* of Brussels, the municipal authorities of Zurich are considering a proposal that they should purchase the engineering works of the Escher Wyss Co. in that city for two million Swiss francs and re-let them to that concern at an annual rental of 100,000 fr., with an option to repurchase until 1940. The object of the proposal is to prevent the concern having to be wound up, which would mean the loss of a valuable foreign clientele to Switzerland and the throwing out of employment of about 1,400 people. A clause in the proposed scheme provides that the municipality of Zurich should make good any losses sustained by the company up to a sum of 500,000 fr. per annum.

A German Cable Deal

The Rheydt Kabelwerke Gesellschaft, of Rheydt, is increasing its capital with the object of acquiring the bulk of the shares and control of the Deutscher Kabelwerk Gesellschaft, of Berlin.

The Iraq Electrical Market

A report on the economic conditions in Iraq has been prepared for the Department of Overseas Trade by Mr. J. P. Summerscale, Commercial Secretary to H.M. Embassy, Bagdad (Stationery Office, 1s. net). Mr. Summerscale states that during the mandatory regime the number of British officials and residents was considerably greater than now, but there are still British communities of some importance in Bagdad and Basra. These, together with the general use of English in commercial correspondence, afford United Kingdom trade certain intangible advantages. As regards general trade the United Kingdom has held its position against foreign competition with the exception of the Japanese, who have made a successful bid for the textile market. The imports of machinery rose from 314,628 Iraq dinars (1 dinar = £1) in 1933-34 to I.D.332,000 in 1934-35, the United Kingdom's share falling slightly from I.D.210,093 to I.D.207,000. Imports of stationary engines form a major part of the total machinery purchased, imports from the United Kingdom amounting to I.D.58,977 in 1934-35 out of a total of I.D.66,579. A growing preference is being shown for the Diesel and semi-Diesel type of engine. The demand for medium-powered engines is good, but that for small engines up to 10 h.p. is negligible. The irrigation schemes at present in course of execution will eventually lead to an increased demand for pumps, but this factor is unlikely to be effective before 1939. In 1934-35 electrical equipment to a total value of I.D.61,000 was imported into Iraq, of which about two-thirds came from the United Kingdom. Radio transmitting and receiving apparatus formed a large part of the total, but satisfactory business was also done in United Kingdom wiring, electricity meters and fans. United Kingdom radio receiving sets of four or five makes are on the market, but the models so far supplied are not well suited to the country, and the prices are not competitive.

World Tin Consumption

The December issue of the Bulletin of the International Tin Research & Development Council, issued by the Hague Statistical Office, gives the world output of tin in October last as 15,068 tons, against 10,240 tons in September, 1935, and 8,638 tons in October, 1934. In the year ended October world output increased by over 25 per cent. to 129,514 tons. At the end of November, 1935, world visible stocks stood at 15,332 tons, or approximately 11 per cent. of the current annual rate of consumption. The Bulletin affords further evidence of replenishment of "invisible" stocks, the total increase in these stocks during the months of September and October being approximately 3,600 tons.

The world output of tinplate in the year ended October, 1935, is given as 3,307,000 tons, compared with 3,191,000 tons in the previous year, and the total output of motor vehicles is shown as 4,563,000, against 3,628,000 in the previous year.

Manchester Public Lighting

In the "Power Service Bulletin" of the Manchester Corporation Electricity Department, an outline is given of the organisation called for in the maintenance of public street lamps. A fleet of electrically operated tower vehicles is used for routine cleaning on main roads, and two petrol-driven tower wagons patrol the main roads at night. A comprehensive card-index system facilitates the changing of old lamps, and also gives a check on the performance of lamps of different types.

Russian Orders for Great Britain

The *Bulletin* of the Russo-British Chamber of Commerce states that, according to the figures issued by the U.S.S.R. Trade Delegation in the United Kingdom, the orders placed in Great Britain by the Soviet trading organisations during October amounted to £891,316, as compared with £574,466 in the corresponding month of 1934. In the first ten months of last year the value of orders placed and purchases made was £8,653,844, as compared with £8,337,263 during the first ten months of 1934, an increase of approximately 4 per cent. The following table shows the principal orders of electrical and allied material placed during the respective periods :—

	October, 1935.	October, 1934.	Jan.–Oct., 1935.	Jan.–Oct., 1934.
	£	£	£	£
Machinery and equipment	10,216	58,552	1,786,069	1,263,614
Steel and ferrous alloys...	39,498	9,100	672,164	1,165,490
Non-ferrous metals ...	314,296	161,422	2,360,454	1,668,893
Rubber	159,302	131,427	900,973	2,299,592

British Trade in Palestine

A group of Members of Parliament draws attention to the great and increasing opportunities this year for British trade in the Near East through the regeneration of Palestine and the surrounding territory. The development of this part of the world has been one of the few bright features during the recent years of depression abroad. Since 1931 the imports of Palestine alone have increased nearly threefold. In 1931 they amounted to £5,940,000. In 1934 they totalled £15,153,000, while for this year, if the annual figures bear out the promise of the half-yearly ones, Palestine's imports will be £17,000,000 or more. Moreover, building and agricultural development is proceeding at a rapid pace, and there is consequently a steady and increasing demand for machinery, building materials, etc. British manufacturers are sharing in this development, but not to the extent they should—and would, if they took a more active interest in this important market. For instance, during the half-year ended June 30th, 1935, British exports to Palestine amounted to only £1,108,842 out of a total purchase by Palestine of £8,475,000. An opportunity for British trade to obtain a better share of this expanding market is offered by the Levant Fair, which is to be held at Tel-Aviv, in Palestine, in May this year. There is a British Pavilion at this Fair, and arrangements have been made in Palestine for the formation of a British Exhibitors' Committee, which will attend to all matters in connection therewith. The Federation of British Industries and the Department of Overseas Trade are also taking a friendly interest. These efforts, however, will be of little avail unless British manufacturers themselves begin to take action in the matter. Recent news indicates that many European countries are waking up to the value of this rapidly expanding market, and it is therefore essential that our manufacturers and exporters should take early and practical advantage of the tendency which still obtains in Palestine to give first preference to the British-made article if no Palestinian one is available.

Calendars, Diaries, Etc.

Accumulators of Woking (1928), Ltd., has selected an excellent etching of Durham Cathedral, by Oswald Fletcher, for its calendar.

Messrs. Francis Polden & Co., Ltd., have again sent us a diary in red leatherette with pockets at the front and back, together with a calendar with a date marking device.

We have received from the Automatic Electric Co., Ltd., a useful everpointed pencil in a black and gilt casing.

Switchgear & Cowans, Ltd., has sent us two packs of playing cards in a neat box of dark blue leatherette.

The calendar of Messrs. T. J. Grainger & Co., Ltd., has large daily slips with red figures.

The desk calendar of Messrs. B. S. & W. Whiteley, Ltd.,

has daily slips with quotations from the works of popular writers.

The diary of the Mercury Switch Manufacturing Co., Ltd., is neatly bound in dark blue limp leather.

"Madge Evans," an attractive platinum blonde, adorns the calendar of the Concordia Electric Safety Lamp Co., Ltd.

Rotunda, Ltd., has sent us a calendar with large daily slips on a card drawing attention to some of its products.

Views of beauty spots and places of interest in its area have been selected by the North Metropolitan Electric Power Supply Co. for its calendar, which has monthly sheets. Each sheet contains a reminder of the company's domestic service.

The pocket diary of Messrs. William Geipel, Ltd., is bound in dark green leatherette and includes engineering tables arranged by the chairman of the company.

Mr. Geo. Barnard has sent us a re-fill for his desk calendar, together with a diary bound in imitation crocodile leather.

"Gorgeous" is the appropriate title of a lady in black (reproduced from a painting by Rolf Armstrong) upon an attractive block calendar from the Supra Electrical Co.

We are indebted to Messrs. Benjamin Electric, Ltd., Tariff Road, Tottenham, for a very useful pocket lighter.

The calendar of Messrs. Brittain, formerly Langdon-Davies Electric Motors, has monthly sheets over which appears an illustration of an electric motor.

The block calendar of the Revo Electric Co., Ltd., bears a view of the company's works at Tipton, Staffs. Each of the daily slips bears a quotation.

Radio Wholesalers' Dinner

The first dinner of the Radio Wholesalers' Federation (president, Mr. A. G. Beaver) is to be held at the Savoy Hotel, London, W.C.2, on January 23rd.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, January 1st.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/3 to 2/9	1d. inc.
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£201	£4 dec.
Grade II... ... ... ,,	£139	£2 dec.
Grade III ... ... ,,	£73	£1 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7¾d.	—
c ,, Tubes (solid drawn) ... ... ,,	9¼d. to 10d.	—
c ,, Wire, basis ... ... ,,	7¾d.	—
c Copper Tubes (solid-drawn) ... ,,	10¼d.	—
g ,, Bars (best selected)... ... per ton	£66	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£39 10s.	—
d ,, ,, Wire Rods ... ,,	£45 10s.	—
d ,, ,, H.C. Wire ... per lb.	7 1/16d.	—
f Ebonite Rod ... ... ,,	1/6 to 2/- plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	6¾d.	—
i Iron, Pig, (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£17 15s.	£1 dec.
g Mercury ... ... per bot.	£12/7/6 to £12/18/6	1s. inc.
e Mica (in original cases) small ... per lb.	6d. to 1/-	—
e ,, ,, medium ... ,,	5/- to 10/-	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11¼d.	—
p ,, ,, rolled strip & sheet ,,	11¼d.	—
p ,, ,, wire ... ... ,,	1/0½	—
o Platinum ... ... per oz.	£7 17s. 6d.	—
d Silicium Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£14 11s. 3d.	6s. 3d. dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£218 10s.	£2 15s. dec.
m ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A leaflet on the new type "MH40" triode valve for microphone amplifiers.

English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publications dealing with the "Triple-Three" washing machine, fractional h.p. motors and current-limiting reactors. The company has issued, in conjunction with the Associated Equipment Co., Ltd., a well-produced booklet on trolley-buses.

Henley's Tyre & Rubber Co., Ltd., 11, Holborn Viaduct, London, E.C.1.—Particulars of the new "Rallit" rubber mallet.

Vidor, Ltd., West Street, Erith.—A leaflet describing new productions in domestic cooking equipment, and a new shaving mirror.

British Insulated Cables, Ltd., Prescot.—New publications dealing with rent collectors, line taps, Gemmell suspenders, corrosion proofing protection for lead-covered cables, and jointing materials.

Crompton Parkinson, Ltd., Bush House, London, W.C.2.—A new booklet dealing with a.c. motors.

Ionic Alkaline Batteries, Ltd., 26, High Street, London, E.15.—A leaflet illustrating the "Ionic" hand lamp.

Archibald Low Electrics, Ltd., Newarthill, Lanarkshire.—Leaflets describing new water heaters fitted with "Scallak" heating units.

Murex Welding Processes, Ltd., Ferry Lane Works, Forest Road, London, E.17.—A booklet describing the maintenance of railway track by electric arc welding.

Bankruptcy Proceedings

D. Green (trading as North End Radio), wireless factor, 250B, North End Road, Fulham.—The public examination of this debtor was held on December 20th at the London Bankruptcy Court, the accounts showing total liabilities of £701 (ranking £681) and assets "nil." The debtor attributed his insolvency to inability to obtain supplies of proprietary goods, illness, insufficient working capital and keen competition. The examination was concluded.

H. W. King, 124, Hither Green Lane, Lewisham, S.E., wireless goods dealer.—The receiving order herein was made on a creditor's petition, and the statement of affairs which has been lodged discloses gross liabilities of £1,786, of which £1,775 is expected to rank for dividend, with net assets of £58, leaving a deficiency of £1,717. Debtor attributes his failure to heavy overhead charges, bad debts and keen competition.

S. P. Wing, 395a, Cotmanhay Road, Ilkeston, wireless dealer, etc.—At the public examination held in this matter at the Court House, 20, St. Peter's Churchyard, Derby, on December 17th, debtor said his failure was due to bad debts contracted during the early part of his trading; free servicing of wireless sets and general losses on their sale; increased competition and overhead expenses. His statement of affairs showed liabilities of £587, and a deficiency of £368. The examination was concluded.

L. G. Hosier, electrical engineer, Watling Street, Radlett.—Receiving order made December 18th on a creditor's petition.

J. H. Read, electrical engineer, 100, High Street, Erdington, Birmingham.—Trustee, Mr. R. K. Clark, 159, Great Charles Street, Birmingham, Official Receiver, released December 16th.

J. Watkins, radio dealer, 25, Bailey Street, Brynmawr.—Trustee, Mr. R. Betts, 34, Park Place, Cardiff, released December 18th.

Company Liquidations

Johnson and Murrell Electric Co., Ltd., 223, Upper Thames Street, London, E.C.2, electrical manufacturers and wholesale suppliers.—The statutory meeting of creditors herein was held on December 30th at the offices of Messrs. Tippetts, 11, Maiden Lane, E.C.4. A statement of affairs as at December 27th last was submitted, showing liabilities of £2,495, of which £671 was due to the trade; there were cash creditors for £1,642, the bank were creditors for £103, the landlord's claim amounted to £60, and wages due totalled £18. The total assets were £574, with a deficiency, subject to realisation and costs of liquidation, of £1,921. It was reported that the company was formed on September 1st, 1924, with an authorised capital of £5,000. The company's operations had never been successful, and there was a considerable falling off in the turnover from the commencement, chiefly owing to competition. Mr. E. F. Johnson had advanced money to the company in an endeavour to pull the business round. The landlord had levied execution recently on the stock and effects in respect of his claim of £60. Mr. Johnson intimated his willingness to withdraw part of his claim to the extent of £600. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. A. C. Jones, 10, Clovelly Gardens, London, S.W.2, as liquidator, with a committee of inspection.

Wallace Drew, Ltd., electrical and radio dealers, Mount Pleasant Road, Tunbridge Wells.—The statutory meeting of creditors was held on December 27th in London. A statement of affairs submitted disclosed liabilities of £5,551, of which £3,578 was due to the bank, who were personally secured, and £1,189 to creditors in respect of goods supplied. The net assets were £674, leaving a deficiency of £4,876. It was reported that the company was formed in 1931, with a nominal capital of £10,000, of which £1,800 had been issued for cash. At the outset it was the intention of the directors to open a chain of shops, but after the first year's trading they varied their policy owing to the severe reduction of list prices by manufacturers. During last year trading conditions in the industry continued to be very difficult, due to the slackening off of public demand. The last balance sheet of the company for the year to March 31st, 1935, showed sales of £5,578, purchases £3,184, and a loss of £1,384. A resolution was passed in favour of the appointment of Mr. R. S. Mays-Smith, 56, Cannon Street, E.C.4, as liquidator, with a committee of inspection.

Lamplugh Radio, Ltd.—Meeting January 27th at Midland Chambers, Warwick Passage, Corporation Street, Birmingham, to receive an account of the winding up by the liquidators, Messrs. C. E. Lucas and F. E. Bendall.

Private Arrangements

H. E. Stacey, radio dealer, 121, Lansdown Road, Leicester.—At the meeting of the creditors of the above the statement of affairs showed ranking liabilities of £181. After allowing £3 for preferential claims the net assets were £77, with a deficiency of £104. A resolution was passed confirming the deed of assignment already executed, and a committee of three of the creditors was also appointed.

Electricity Supply

Lighting, Domestic, Power

Amble (Northumberland).—SUB-STATION.—A sub-station is to be erected near the harbour at a cost of £2,000.

Aylesbury.—MAINS.—The Town Council has sanctioned mains extensions at Waddesdon, Heath End and Brill, and the substitution of an underground cable for a section of overhead line at Princes Risborough.

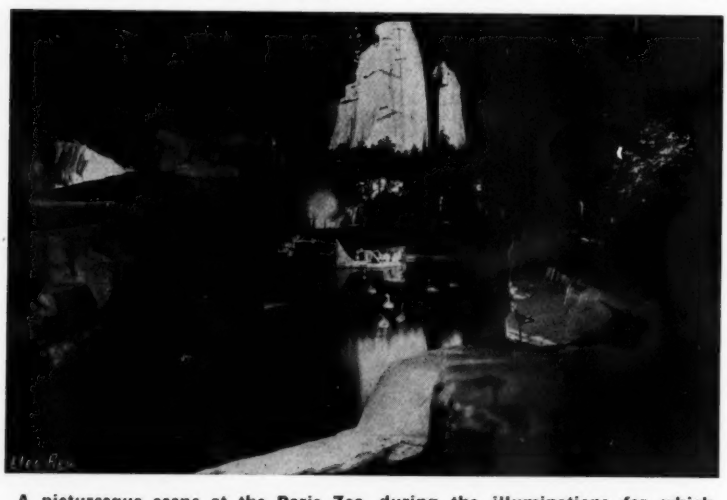
LOWER CHARGES.—The electricity charges have been revised as follows: Maximum average price reduced from 7d. to 6½d. per kWh in Aylesbury, and, in the rural area, from 8d. to 7½d. per kWh; business premises, "unit" charge ¾d. instead of 1d. in the town and 1d. instead of 1½d. in the rural area; domestic premises, "unit" charge reduced from 1d. to ¾d. in the town and from 1½d. to 1d. in the rural area.

Barnstaple.—APPLICATION TO EXTEND POWER STATION.—Mr. H. Nimmo, M.I.E.E., held an inquiry on December 20th and 21st into the application of the Town Council to extend its generating station by the installation of two 450-kW diesel-engine generating sets, together with the necessary auxiliary plant. Reference was made to an offer of a bulk supply through the undertaking of the Bideford and District Electric Supply Co., Ltd. Mr. J. W. Hadfield, borough electrical engineer, gave evidence of the rapid growth of the demand for electricity in Barnstaple and spoke of the risk of failure by taking electricity from outside, with the distribution lines carried over very rough country subject to storm.

Bexhill-on-Sea.—PROPOSED TWO-PART TARIFF.—It is proposed to introduce a two-part tariff, but the Electricity Committee considers that this should not be done until a showroom and hiring facilities are in existence, the showroom to include all classes of electrical apparatus excepting lamps.

Blaydon-on-Tyne.—NEW CABLES.—Plans submitted by the North-Eastern Electric Supply Co., Ltd., for laying underground cables in May and June Avenues, Winlaton Mill, have been approved by the Urban District Council, but the Council has asked that a proposed overhead line at the Avenue, Winlaton estate, should be replaced by an underground main.

Bolivia.—A LARGE HYDRO-ELECTRIC SCHEME.—The President of the Bolivian Republic has granted a £50,000,000 concession for the harnessing of the waters of Lake Titicaca, in the Andes, to operate what will be, it is claimed, the largest hydro-electric plant in South America. The concessionaire is Herr Mauricio Hochschild, the German principal of a large South American ore-buying company. The concessionaire company has promised to secure the money by bond issue, and the Bolivian Government will receive five per cent. of the gross earnings. The work will take five years to complete. Outlining the power scheme, Herr Hochschild states that it is proposed to supply the whole of Bolivia's industrial power, to electrify the railways and to operate a smelter, the surplus water being used for irrigation. Sorata, ten miles from the eastern shore of the lake, has been selected as the site for the power plant, according to Herr Hochschild's engineers. It is proposed to tunnel into the lake from lower ground in order to obtain a perennial source of power. Titicaca, the largest lake in South America, lies on the frontiers of Peru and Bolivia, at an altitude of 13,000 ft. It has an area of more than 3,000 square miles, with a maximum depth of 700 ft.—*Reuter*.



A picturesque scene at the Paris Zoo during the illuminations for which white, bue, green red and yellow lighting was used. In the foreground is the waterfowl pond and, behind it, the great rock

Bradford and Melksham.—SUPPLY EXTENSION.—The West Wilts Electric Light and Power Co., Ltd., has informed the Rural District Council that it hopes to give a supply of electricity to Shaw and Whitley this year.

Brechin.—LIGHTING AT EDZELL.—The Urban District Council has agreed to proceed with the introduction of electric lighting to Edzell, in accordance with a majority vote of the villagers.

Bredbury and Romiley.—TARIFF FOR CHURCHES.—The Urban District Council has introduced a tariff for heating places of worship, the rates being ¾d. per kWh from 6 a.m. to 10 p.m., and ¼d. per kWh at other times.

Brierley Hill.—STREET LIGHTING.—A recommendation that the public lighting agreement with the Dudley, Brierley Hill and District Gas Co. should be renewed for a period of five years was referred back at a recent Council meeting, it being urged that electric street lighting should be considered.

Burnley.—LOAN.—The Corporation has approved a proposal to borrow £5,000 to meet the Electricity Department's anticipated expenditure on sub-station equipment and transformer kiosks.

Chalford.—SUPPLY PROMISED.—The West Gloucestershire Power Co., Ltd., has informed the Parish Council that a supply of electricity will soon be available in the area.

Chester.—CHANGE-OVER.—The Electricity Committee has obtained sanction to borrow £4,245 for the completion of the change-over scheme.

Chipstead and Merstham.—LOWER CHARGES.—The County of London Electric Supply Co., Ltd., has reduced the lighting flat rate from 6d. to 5½d. per kWh, and the "unit" charge on the domestic and business two-part tariffs from 1d. to ¾d.

Chislehurst-Sidcup.—NEW CABLES.—The Urban District Council has arranged with the Chislehurst Electric Supply Co., Ltd., for mains and service cables to be laid free of cost to supply Council houses in Barham Road.

Clitheroe.—CABLE-LAYING SCHEMES.—A ring main in the borough is to be completed by laying a cable from Commercial Mill to Goosebutts, while the question of providing a supply to Middop is under consideration.

Cransley (Northants).—CHURCH INSTALLATION.—A system of electric heating and floodlighting is being installed at Cransley parish church, near Kettering. Tubular heaters will run along the backs of the pews, and will also be placed in racks beneath the windows and high up the walls to avoid down draughts. Wooden angels which terminate the beams on each side of the nave are to be individually flood-lighted, and three large lights will illuminate the chancel and sanctuary. The aisles will be lighted by seven electric candelabra.

Denny and Dunipace.—LOWER TARIFF.—The Burgh Council has decided to reduce the flat rate by ½d. to 3d. per kWh (with prepayment meters 3½d. per kWh).

Dewsbury.—LOANS.—The Electricity Committee has obtained sanction to a loan of £22,500 for mains and services and is seeking permission to borrow £15,000 for meters.

Duns (Berwickshire).—GAS OR ELECTRICITY?—The electricity and gas companies are both to provide experimental street lighting to enable the Council to make its choice.

Finchley.—LOAN.—Sanction to borrow £30,000 for mains and services is being sought by the Electricity Committee.

France.—ILLUMINATIONS AT THE PARIS ZOO.—An effective illumination scheme was carried out recently at the Paris Zoo, the large rocks lending themselves well to such treatment. Three hundred projectors were used. A supply of electricity was taken from the four existing sub-stations, reinforced by the installation of additional transformers, and the total load amounted to 220 kW. As far as possible the projectors were installed without special standards, only ten of which were used. The most interesting section of the scheme was the lighting of the great rock. This was done by two batteries of projectors situated about 90 deg. apart. The first comprised ten of 1,000 W each, and the second forty-eight, divided into three groups of white, blue and green, and red and yellow. A complete switchboard with dimmers permitted a variation of the lighting combinations. The lion pit was lighted by nine projectors, seven of which were yellow, special shades being provided to avoid a blinding light, and two were red, the light from which was thrown against the rock background. The underwater lighting of the seal pond was arranged by means of seven 1,000-W projectors. For the lighting of the shrubbery, mercury-vapour and sodium-vapour lamps were used. The accompanying photograph from our Paris correspondent gives some idea of the excellence of the completed scheme.

ELECTRIC THRESHING.—Efforts have been made in the Champagne region to extend the application of electric threshing. In places where the threshing is done by companies who rent out the machines, they have been persuaded to test electrical threshing, the electricity companies furnishing the motors and sometimes renting them to the threshers when they decide to use electricity. In places where there is no existing modern threshing the supply companies build threshing machines and rent them to co-operative associations which

thresh the grain for the farmers. In all cases it has been necessary to build movable sub-stations which can be connected to the 15 kV or 5 kV lines. So far the campaign has proved very successful.

ROAD LIGHTING.—Experiments with sodium-vapour electric-discharge lamps are being carried out along National Highway No. 7 between Pougues and Nevers.

Great Yarmouth.—PARADE SCHEME.—The borough electrical engineer is co-operating with the borough engineer in a £38,500 scheme for the development of the central parade. The project comprises the construction of a new outer promenade, a bandstand and auditorium, etc. A centrepiece for the gardens which are to be laid out between the marine parade and the new promenade will consist of a floral clock flanked by two illuminated cascade fountains.

Grimsby.—DISTRIBUTION.—The Electricity Committee is seeking sanction to borrow £47,000 for distribution works.

Hastings.—CONCESSIONS.—Various electricity charges and rentals of apparatus are to be reduced by the Town Council as from March 9th. With regard to the county borough, the multi-part tariff for business premises is to be amended by reducing the fixed charge per quarter where the capacity of the lamps exceeds 5 kW, while the "unit" charge will be reduced to 0.4d. for all energy in excess of 20,000 kWh per quarter. The fixed charge for power under the multi-part tariff is to be 12s. 6d. per quarter per h.p. instead of 16s. 8d., while for floodlighting and exterior lighting of business premises there is to be a new tariff with a fixed charge of £1 15s. per quarter for each kW of lighting installed (minimum 11s. 8d.), with a "unit" charge of ¼d. The rentals of various types of cookers, water heaters, and other apparatus are to be modified. In the area of the Hastings Electricity (Extension) Special Order, 1927, there are to be concessions on somewhat similar lines, and the reductions will also include a lower heating, cooking, and domestic power flat rate of ¾d. per kWh for all consumption above 240 kWh per quarter, while the multi-part tariff fixed charges for domestic and business premises are to be 10 instead of 50 per cent. above the rates applying within the county borough.

Hebden Bridge (Yorks).—MODIFIED DOMESTIC TARIFF.—As from January 1st the Urban District Council has amended its domestic tariff in favour of the consumers. The new standing charge is 15 per cent. per annum of the rateable value, except in the case of houses of under £7 r.v., which will have a fixed charge of 5s. per quarter. For the first 100 kWh consumed per quarter the former running charge of ¾d. per kWh will be operative, but for all energy in excess of that amount ½d. per kWh will be charged.

Hertford.—SUPPLY TO BENINGTON.—The Rural District Council has approved a scheme submitted by the North Metropolitan Electric Power Supply Co. for supplying electricity to Benington.

Hoylake.—LOANS.—Application has been made by the Urban District Council for loans of £15,000 for mains and services, and £1,500 for transformers.

Isle of Thanet.—EXTENSION OF AGREEMENT.—The public authorities concerned have agreed with the Isle of Thanet Electric Supply Co., Ltd., for the extension of its tenure of the electricity undertaking until the end of 1965, on condition that the maximum charge over the whole of the area of supply (Margate, Broadstairs, Westgate-on-Sea, and Birchington) as from January 1st shall be a flat rate of 7d. per kWh, with two-part tariffs as already operating at Margate.

Keighley.—REVISED CHARGES.—The Electricity Committee is submitting to the Town Council a revised scale of electricity charges to replace the existing "point" system. The new scheme is a two-part tariff for domestic users, based on an annual standing charge of 15 per cent. of the rateable value up to £50, or 10 per cent. on premises above that value (minimum £1 16s.), and energy at ½d. per kWh, less a discount of 2½ per cent. on the "unit" charge if payment is made within twenty-eight days. Domestic meter rents will be reduced from 10s. to 8s. per annum for one meter, and from 2s. 6d. to 2s. for additional meters. For slot meter consumers the flat rate charge is reduced from 6d. to 5d. per kWh. The standing charge for boarding schools, hostels, nurses' homes, and houses combined with premises used by doctors, dentists, chiropodists, &c., will be 17½ per cent. of the rateable value up to £50 and 12 per cent. on any remainder.

Kingston-upon-Thames.—MOVE TO SECURE TARIFF EQUALITY.—In 1930 the Council approached the London and Home Counties J.E.A. with regard to the electricity charges paid by residents in that part of Ham which was incorporated in Kingston under the review of county districts, but which is in the J.E.A.'s area of supply. Nothing was done at the time, and the Electricity Committee now recommends that the J.E.A. should be communicated with again to see if some arrangement cannot be reached so that all Kingston people are charged at the same rates.

Kirkcudbrightshire.—PROGRESS OF DISTRIBUTION SCHEME.—It was reported to the County Council recently that the first three years' programme in regard to the electricity distribution scheme had cost £120,192, in addition to which there were commitments amounting to £40,925 in respect of lines in course of construction or contemplated. In the near future it would be necessary to consider the possibility of providing supplies to Parton, Corsock, Carsphairn, along the Gatehouse to Creektown route, and other developments. It was decided that the Electricity Committee should be authorised to expand the scheme to a total cost of not more than £180,000.

Lancaster.—RURAL ELECTRIFICATION.—The Corporation's £72,000 scheme for the electrification of the Lancaster rural area has been completed, the supply to the northern area being inaugurated on Wednesday, December 18th. Actually the scheme was scheduled to finish in June next, but, owing to

The experimental lighting of part of Rochdale Road, Halifax, by fourteen 250-W electric-discharge lamps has proved so satisfactory that the Electricity Department is to illuminate the remainder of the thoroughfare with the same system

the co-operation between the contractors, the Corporation, and the landowners, the time taken was reduced by six months. Schemes for the electrification of the Forton and Dolphinholme district are now contemplated.

LOANS.—Application is to be made to the Electricity Commissioners for sanction to borrow £6,000 for plant and mains extensions.

Llandovery.—INQUIRY.—Mr. S. Gordon Tucker held a Ministry of Transport inquiry last week into the application of the West Cambrian Power Co., Ltd., for permission to erect overhead lines to supply electricity in the borough. The Town Council and the Carmarthenshire County Council opposed the application.

London.—CAMBERWELL LIGHTING.—That there may be a change-over in street lighting in the borough is suggested by the *South London Press*. Tenders of the County of London Electric Supply Co., Ltd., and the South Metropolitan Gas Co. have been before the Council since November, but so far no decision has been reached by the sub-committee which is dealing with the matter. At present there is very little electric street lighting in the borough.

BATTERSEA.—The Electricity Committee is to provide electricity services at 137 premises at a cost of £1,022. In connection with the rental wiring scheme the committee has decided that the cost of the installation of heating points shall be borne by the Council and repaid by the consumers over a period of seven years, and that consumers shall be required to enter into an agreement for a period of not less than three years.

ST. PANCRAS.—Applications for supplies in Euston Road, Gillies Street, and Miller Street will necessitate mains extensions costing £656.

ISLINGTON.—During the past year the Electricity Department has been busily engaged in extending its network of mains, and the £10,000 programme authorised in October, 1934, was practically completed at the date of the last Council meeting. A further scheme, estimated to cost £16,000, has now been approved, the work to be carried out by direct labour. When this is finished all the roads in the borough, excepting certain cul-de-sacs and semi-private approaches, will then have a main on at least one side.

Poland.—ELECTRICAL PROGRESS.—According to the recently issued report of the Société d'Entreprises Eléctriques en Pologne for the financial year 1934-35, its various affiliated concerns in Poland are now supplying power to 63,556 consumers, an increase of 4,236 during the past twelve months. During the same period the load on the different power stations increased from 43,367 to 47,100 kW. A new 3,200-kW steam turbo-alternator is being added to the power station at Bialystok, and one of 5,600 kW to that at Czestschowa, in order to meet the growing demand in both areas.

NEW POWER STATION.—It is proposed to establish a hydro-electric power station with a capacity of 50,000 kW at Roznowie. This will be the largest of its kind in Poland and will take three years to build. Tenders have been invited for hydraulic turbines and four generators. The Warsaw *Gazeta Handlowa*, which states that tenders will be accepted up to February 10th, says that machines of the size required are made in Austria, Germany, Switzerland, America, and Sweden, but Great Britain is not mentioned.

Portsmouth.—REWIRING A HOSPITAL.—The out-patients' department and the old portion of the nurses' home at the Royal Portsmouth Hospital are to be rewired at a cost of £244.

Seaham.—ELECTRICITY OR GAS?—That miners living in colliery houses at Dawdon and New Seaham are being refused electricity supplies because it would curtail the consumption of gas from the Seaham Gas Co. was alleged by Mr. J. H. Blackwell, chairman of the Electricity Committee, at a meeting of Seaham Council. It was reported that the Committee had written to the colliery company asking them to receive a deputation from the Council on the matter of supplying electricity to the houses, but the company had written stating that the Dawdon Miners' Lodge had requested that the matter be left in their hands. Mr. Blackwell added that a year ago a number of residents in both districts had asked to be supplied with electricity. The Council had asked the company for permission to wire the houses, but it had replied that previous wiring done by the Council was not up to standard. While this was admitted by Mr. Blackwell, he stated the Council had gone to considerable expense to rectify the complaint.

South Africa.—NEW PLANT WANTED FOR PIETERSBURG.—The Town Council of Pietersburg, Northern Transvaal, has decided to borrow £16,000 for extensions to the power station.

JOHANNESBURG'S NEW INSTALLATION.—A 56-ton alternator has just been delivered to the municipal power station in Jeppe Street. It is part of the two new 15,000-kW generators which are being installed. These generators, with boilers, cooling towers, and other equipment, will be ready by the time the Empire Exhibition opens next year and will bring the total capacity of the station up to 70,000 kW. In addition, another 20,000-kW set has been sanctioned, and tenders have been invited for the installation of the plant.

Wallasey.—L.V. FEEDER.—Permission is being sought by the Electricity Committee for the erection of an overhead low-voltage feeder between the Leasowe housing estate kiosk and the Wallasey Bidston sewage pumping station.

Wayland.—RURAL SUPPLIES.—The East Anglian Electric Supply Co., Ltd., intends to extend its overhead line from Watton to Great Ellingham, and in a letter to the Wayland Rural District Council it was stated that Old Buckenham would be included in the new works scheduled to be carried out in 1936, provided the directors gave their approval. The Council has asked that Neaton and Carbrooke should be included in the parishes due for early attention.

Wareham and Purbeck (Dorset).—VILLAGES AND ELECTRICITY.—Speaking at a recent meeting of the Rural District Council, Major R. C. Mansel urged that efforts should be made to get electricity supplies in all parts of the area, and it was decided to ask the Bournemouth and Poole Electricity Supply Co., Ltd., to send a representative to discuss the position.

Traction

Argentina.—DIESEL-ELECTRIC PERFORMANCE.—A 450 b.h.p. diesel-electric railcar which was placed in service on the Buenos Ayres Western Railway in October, 1934, has covered 125,000 miles without repair, and a smaller vehicle of 140 b.h.p. has run 51,000 miles in less than ten months. On the Buenos Ayres Great Southern Railway the five diesel-electric units which work the suburban traffic out of the Argentine capital have covered an aggregate of 550,000 miles.

Brighton.—TROLLEY-BUSES.—The Town Council has agreed to take a poll of the ratepayers on January 8th regarding the trolley-bus Bill.

London.—REFUSE COLLECTION IN WESTMINSTER.—When a recommendation to purchase electrically propelled vehicles for refuse collection was before the Westminster City Council recently, Commander P. H. Edwards asked how it was that, having only just started changing from horse-drawn to petrol-engine transport, they were now starting with electric vehicles. In reply, it was stated that although the policy seemed revolutionary electrically propelled vehicles had improved so much during the last few years that they were coming more into commercial use. Their advantages included efficiency, cheapness (an electric "mechanical horse" could be run three miles for a penny) and silence.

Scotland.—BOW COLLECTORS REPLACE TROLLEY WHEELS.—Aberdeen and Dundee municipal tramway systems have followed the lead of Glasgow Corporation by adopting the bow collector in place of the trolley wheel on tramcars. Aberdeen has gradually adopted the same system, and Dundee is arranging to do likewise.

Swansea.—FUTURE OF TRANSPORT SYSTEM.—The Borough Council has approved the draft of the Parliamentary Bill whereby the Council is to take over the passenger transport system of the town. There is a possibility that trolley-buses will replace the trams.

Wallasey.—WIRRAL RAILWAY.—The Corporation is to arrange a further interview with the L.M.S. Railway Co. regarding the proposed electrification of the Wirral railway.

Wednesbury.—TROLLEY-BUSES WANTED.—The Wolverhampton Transport Department is being asked by the Wednesbury Town Council to extend its trolley-bus system to the White Horse, Wednesbury.

Communications

Brazil.—TELEGRAPH AND TELEPHONE EXPANSION.—At the end of 1934 there were 109,545 miles of telegraph wires in operation, as compared with 108,596 miles at the close of 1933. With regard to telephones it is estimated that there are now about two million instruments in use in the country, as against 39,200 twelve years ago.

France.—COLONIAL BROADCASTS.—The Government Director of Broadcasts, M. Pellenc, revealed in a speech at the opening of a radio exhibition at Limoges recently that the most powerful short-wave wireless transmitters ever constructed are to be used shortly for French colonial and foreign broadcasts.—*Reuter.*

Germany.—TELEVISION.—The Witzleben (Berlin) television station, which was put out of commission by the fire at the recent Berlin Radio Exhibition, is again transmitting.

Great Britain.—POST OFFICE PROGRESS.—The efforts made during 1935 to popularise the telephone and telegraph services succeeded to a remarkable degree. Altogether 350,000 new telephones were installed, making a net increase of 180,000 over the previous year. At the end of November there were 2,500,000 telephones in use, and the number of telephone calls during the year was the highest on record, the effective local calls totalling 1,755 million, or 158 million more than in the previous year, while the number of trunk calls rose by 13 million to 95 million. Special attention has been given to rural subscribers, the radius within which normal tariffs apply being increased from two to three miles. By last March all but 1,100 of the 13,000 post offices in rural areas had been provided with a telephone service. Many records in telephone and telegraph traffic were broken this Christmas. The Central Telegraph Office reported the receipt of 325,000 telegrams on Christmas Eve, an increase of 66.3 per cent. over December 24th, 1934, while telephoned telegrams rose by 103 per cent. On Christmas Day telegrams increased by 114 per cent., and on Boxing Day by 56 per cent. The shilling telephone calls proved very popular; for instance, on Christmas Eve the London trunk exchange received 10,000 calls between 5 p.m. and midnight, as compared with 7,500 a year ago, and 1,500 on a normal night before the introduction of the shilling call.

LINK WITH AFRICA.—The Postmaster-General announces that a telephone service is now available between all parts of Great Britain and Northern Ireland, and Brazzaville, French Equatorial Africa.

Hull.—LOWER TELEPHONE TARIFF.—The Telephone Committee has adopted a recommendation that the extension instrument tariff without intercommunication, in connection with the measured service rates, shall be reduced from 16s. to 14s. per annum.

Irish Free State.—AIRCRAFT RADIO STATION.—A radio station for aircraft is to be established at the Baldonnel Aerodrome, Dublin, as a step towards providing a cross-Channel air service to Great Britain. The contract has been placed with the Marconi Co., and the cost of the installation will be £3,350.

South Africa.—POPULARITY OF THE TELEPHONE.—The annual report of the Postmaster-General for 1935, which is very attractively produced in commemoration of the 25th anniversary of the Union, discloses the fact that telephone assets have increased from £493,068 in 1910 to £9,692,264 in 1935; telephones in use from 13,560 to 139,469; and telephone exchanges from 112 to 1,435. A comparison is made of the number of telephones per 100 of population in South African and other cities, with the following results: Washington, 35.3; San Francisco, 35; Stockholm, 32; New York, 20.83; Johannesburg, 16.47; Paris, 14; Cape Peninsula, 13.7; Pretoria, 11.3; Maritzburg, 11.2; Berlin, 10.8; Auckland, 9.9; Port Elizabeth, 9; London, 9; Sydney, 8; Rome, 7.5; and Bloemfontein, 7. The total mileage of line required to serve waiting applicants in the Union is 9,000. It is anticipated that in about a year's time the telephone system of the Witwatersrand will produce an annual revenue of £1,000,000. During 1934-35 altogether 14,000,000 trunk calls were handled. There were 1,286 calls to overseas countries and 2,408 from overseas countries, compared with 871 and 2,081 respectively in the preceding year. There was a loss of £117,676 on telegraphs and a record profit of £242,009 on telephones for the year ended March 31st last.

BROADCASTING CORPORATION.—Senator C. F. Clarkson, Minister of Posts and Telegraphs, announces that Mr. I. W. Schlesinger has withdrawn his acceptance of the invitation to become chairman of the proposed Broadcasting Corporation which is to control all broadcasting activities in South Africa. The Bill to establish a public utility organisation will be introduced in the forthcoming session of Parliament.

Stockport.—TELEVISION AT A CINEMA.—The erection of a new cinema costing £70,000 in Wellington Road South is to be commenced shortly, and provision will be made for television.

Stratford-upon-Avon.—AUTOMATIC TELEPHONE EXCHANGE.—On December 14th the Mayor opened a new automatic telephone exchange to replace the existing magneto manual system. The new exchange incorporates the latest developments in automatic switching plant and is fully mechanised. Six hundred and thirty-four subscribers are connected to the exchange, and the necessary manual services are routed to Leamington Spa exchange over a junction network.

Contract Information

When "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Argentina.—BUENOS AIRES.—January 21st. State Railways Administration. Underground cable, joint boxes, insulating tape, &c. (T.Y. 10269.)*

Army Contracts.—Manufacturers who are not on the War Office list of tenderers and wish to be invited to tender for general stores should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, S.W.1. (See this issue.)

Australia.—BRISBANE.—March 10th. City Electric Light Co. 11,000-V and 415-V switchgear. (T.Y. 10264.)*

MELBOURNE.—February 17th. State Electricity Commission of Victoria. Three oil-insulated outdoor type automatic induction voltage regulators with accessories. (T.Y. 10277.)*

Bexley.—January 20th. Electricity Department. Cable with jointing, transformer, and switchboard. (December 13th.)

Birmingham.—January 8th. Salvage and Stables Committee. Twenty-three lead-plate batteries for electric vehicles. (December 20th.)

January 10th. Electric Supply Committee. Five motor-driven sewage effluent pumps and ancillary works for the Hams Hall power station. City electrical engineer, 14, Dale End (deposit £2).

Blackwell.—January 8th. R.D.C. Two electrical sewage pumping installations, with vertical-spindle centrifugal pumps and motors, for the Hilcote and B. Winning sewage and South Normanton sewage disposal works extensions. A. H. Elliott, Gilcroft Chambers, Church Lane, Mansfield (deposit £2 2s.).

Brecknockshire.—January 6th. County Council. L.p. hot-water heating and electric lighting and power installations at the Brecon County (Girls') School. H. C. W. Strickland, County architect, Watton Offices, Brecon.

Coventry.—January 25th. Electricity Department. 30,000-kW turbo-alternator and two water-tube boilers. (December 13th.)

Dartford.—January 11th. Cable and joint boxes. (December 27th.)

Edinburgh.—January 16th. Corporation. Various works, including electric lighting and heating, at Craigmillar Intermediate school. City architect.

Egypt.—CAIRO.—January 25th. Ministry of Education. 40-kW d.c. generator, control switchboard and six d.c. motors. (T.Y. 10286.)*

Freebridge (Norfolk).—January 8th. R.D.C. Electrically operated pumping unit with accessories for supply of water to houses in Middleton. G. W. Little, housing officer, St. James' Clubhouse Buildings, King's Lynn.

Glasgow.—January 16th. Corporation. Electrical installations at Landressy Street estate. Town clerk (Room 36).

Hull.—Telephone Committee. Public automatic telephone exchange. (See this issue.)

Ilford.—January 24th. Electricity Department. E.h.p. switchboard and oil switches. (See this issue).

Iran.—TEHERAN.—Ministry of Posts, Telegraphs and Telephones. Telegraph poles and accessory equipment. (December 27th.)

Irish Free State.—DUBLIN.—January 31st. Electricity Supply Board. Twelve months' supply of power transformers. (December 20th.)

January 8th. Commissioners of Public Works. Electric lighting at the Custume Barracks, Athlone. T. Cassedy, Office of Public Works (deposit £1).

SWINFORD.—January 10th. Mayo Board of Health. Electrical installations in the new fever hospital. P. J. Munden, 1, South Frederick Street, Dublin (deposit £5 5s.).

Kettering.—January 29th. Electricity Department. 11,000-V switchboard, cable and joint boxes. (See this issue.)

Liverpool.—January 20th. Electric Supply Department. Materials for twelve months. (See this issue).

London.—METROPOLITAN WATER BOARD.—February 25th. Eight steam turbines with centrifugal pumps, electric generators, &c., at the pumping station, Hampton. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £5 5s. to be deposited with the accountant of the Board).

HAMMERSMITH.—January 22nd. Borough Council. Stores and materials for twelve months. (See this issue.)

CENTRAL ELECTRICITY BOARD.—January 27th. 132,000-V overhead transmission lines for the Central England Electricity Scheme, 1928. (December 13th.)

Manchester.—January 21st. Electricity Committee. Electric cookers. (December 27th.)

January 16th. Education Committee. Electrical installations in cottages at Styal Cottage Homes, and alterations and additions to the electrical installations at City Road Municipal school, Hulme. Surveyor's Department, Education Offices, Deansgate.

New Zealand.—WELLINGTON.—February 4th. Public Works Department. Switchgear for the Marereta Tahekeroa and Maungatapere stations. (T.Y. 10274.)*

March 11th. Post and Telegraph Department. 100 miles of insulated bronze wire. (T.Y. 10293.)*

Northern Ireland.—BELFAST.—January 16th. Electricity Department. Materials for twelve months. (December 27th.)

January 18th. Water strainers and electrically operated driving gear for penstocks. (See this issue.)

Salford.—January 7th. Corporation. Two electrically propelled vans. (December 27th.)

January 15th. One 12,500-kVA transformer. (December 27th.)

South Africa.—GEORGE.—February 19th. Municipality. Plant for the reconstruction of the electricity undertaking, consisting of boilers and steam-raising plant, turbo-alternators, one 400-kW alternator and switchgear. E. Val Davies, consulting engineer, Johannesburg.

JOHANNESBURG.—January 27th. Railways and Harbours Administration. Two 25-ton capacity overhead electric travelling cranes. (T.Y. 5579.)*

February 3rd. 10-ton capacity overhead electric travelling crane. (T.Y. 5582.)*

Southend-on-Sea.—January 8th. Electricity Department. Electric-discharge lamps, lanterns and brackets. (December 27th.)

Stockport.—January 7th. Sewage Outfall Committee. Electric motors, &c. W. F. Gardner, borough surveyor, Town Hall (deposit £2 2s.).

Swansea.—January 24th. Electricity Department. Materials for twelve months. (See this issue.)

Swindon.—January 10th. Electricity Department. Underground h.p. cables and sub-station equipment. (December 13th.)

---

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—Town Council. Accepted. Electrical work at sixty-six four-apartment houses to be erected in the Willowbank district.—Stroud & Weir.

Barking.—Electricity Committee. Recommended. Cables for twelve months.—Connollys (Blackley), Ltd.; Hackbridge Cable Co., Ltd.

Berwick-on-Tweed.—Town Council. Accepted. Electrical installations in 100 houses.—R. W. Leek & Co.

Darlington.—Electricity Committee. Accepted. Equipment required to extend a new system of street lighting over the whole of the Great North Road, Darlington area.—General Electric Co., Ltd

Hull.—Education Committee. Accepted. Electrical installations at West school, Endyke Lane (£822).—T. A. Garness.

Leeds.—Electricity Committee. Accepted. **Cables**:—Macintosh Cable Co., Ltd. (£952); Edison Swan Cables, Ltd. (£526); W. T. Henley's Telegraph Works Co., Ltd. (£120); Hackbridge Cable Co., Ltd. (£416); Telegraph Construction & Maintenance Co., Ltd. (£154).

London.—L.C.C.—Accepted. Wiring and fittings for electric lighting, &c., in one block of dwellings in the Duncan Square area, Hackney:—

	£
Jacob White & Co., Ltd. Accepted	1,048
Rhymos, Ltd.	1,180
Frank Angell & Co., Ltd.	1,223
Berkeley Electrical Engg. Co., Ltd.	1,275
A. J. Hewens & Sons, Ltd.	2,041
B. C. Bullard & Co.	2,114
Springvale Electrical Co....	2,188
S. Cowlan	3,219

Electric lighting and power, &c., in the Northern Group Laboratory, North-Western Hospital, Hampstead (£268).—A. J. Hewens & Sons, Ltd. This was the lowest of twelve tenders, the highest being £398. Electric lighting, power, telephones, &c., in the nurses' home extension, Paddington Hospital (£562).—Bell Bros. & Co. (London), Ltd. This was the lowest of eight tenders, the highest being £700. Wiring and fittings for electric lighting and power at the Lamorbey Residential school (£417).—Davis Myer & Co. This was the lowest of twelve tenders, the highest being £816. Wiring and fittings for electric lighting, power, telephones, fire alarms and call bell systems at the nurses' home extension, St. Mary, Islington, Hospital:—

	£
G. E. Taylor & Co. Accepted	691
Francis Polden & Co., Ltd.	760
Read & Partners, Ltd.	775
Davis Myer & Co.	792
Pinching & Walton	796
F. G. Edey & Co., Ltd.	800
W. H. Gaze & Sons, Ltd.	835
Malcolm & Allan (London), Ltd.	837
Electrical Installations, Ltd.	840
J. E. Swann & Co., Ltd.	872
Berkeley Electrical Engg. Co., Ltd.	890
Twentyman & Willmott, Ltd.	1,400

Merthyr Tydfil.—Education Committee. Accepted. Equipment of the laboratory at the Quakers' Yard Miners' Institute (£306).—General Electric Co., Ltd.

Oban.—Town Council. Accepted. Cable and joint boxes at Dalintart housing scheme (£700).—Callender's Cable & Construction Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted. Switchgear (£1,925).—A. Reyrolle & Co., Ltd. Transformers: Twelve 500-kVA with automatic gear (£12,466), one 500-kVA (£444) and two 1,000-kVA (£1,271).—C. A. Parsons & Co., Ltd.

Surrey.—P.A.C. Accepted. Electric lighting at the nurses' home extensions at Guildford (£510).—Buchanan & Curwen, Ltd. Fire alarm system at the Farnham Institution (£176).—Shipton Automatic Telephone Co., Ltd. (London).

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 6th. Institution, London. 7 p.m. Informal meeting. Discussion on "Sound Recording and Reproduction." To be opened by Mr. S. S. A. Watkins.

Meter and Instrument Section.—Friday, January 3rd. Institution, London. 7 p.m. Inaugural address by Mr. O. Howarth.

Mersey and North Wales (Liverpool) Centre.—Monday, January 6th. The University, Liverpool. 7 p.m. "The Effect of Legislation and Regulations upon Electricity Distribution." Mr. W. Fennell.

North Midland Centre.—Tuesday, January 7th. Hotel Metropole, Leeds. 7 p.m. Informal discussion on "Electric Vehicles."

Hampshire Sub-Centre.—Wednesday, January 8th. University College, Southampton. 7.30 p.m. "Generation, Distribution and Use of Electricity on board Ship." Messrs. C. W. Saunders, H. W. Wilson and R. G. Jakeman.

Wireless Section.—Wednesday, January 8th. Institution, London. 6 p.m. "The Radiation Resistance of Aerials whose length is comparable with the Wave Length." Mr. E. B. Moullin.

Dundee Sub-Centre.—Thursday, January 9th. University College, Dundee. 7.30 p.m. "Electric Discharge Lamps and their Uses." Mr. L. T. Davies.

Institution of Engineers-in-Charge.—Saturday, January 4th. 2.30 p.m. Visit to the Battersea Power Station. Wednesday, January 8th. St. Bride Institute, London, E.C.4. 7.30 p.m. "Boiler House Efficiency." Mr. V. R. Chadwick.

Physical Society Exhibition.—Tuesday, January 7th, to Thursday, January 9th. Imperial College of Science and Technology, S.W.7.

Electrical Power Engineers' Association (*South Coast Section*).—Wednesday, January 8th. Electricity Showrooms, Brighton. 7.30 p.m. "Grid Control of Mercury Arc Rectifiers." Mr. Rissik. Thursday, January 9th. Municipal College, Portsmouth. 7.30 p.m. Mr. Rissik's paper.

Institution of Heating and Ventilating Engineers.—Wednesday, January 8th. London School of Hygiene and Tropical Medicine, W.C.1. 7 p.m. "Automatic Boiler Controls." Mr. F. M. H. Taylor.

British Electrical Development Association (*Northern Counties Area*).—Friday, January 10th. Oxford Galleries, Newcastle-upon-Tyne. Carnival ball.

Junior Institution of Engineers.—Friday, January 10th. Institution, London. 7.30 p.m. "Refractory Materials." Dr. J. H. Partridge.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, January 11th. Cardiff. "Some Comparisons in Mine Shaft Signalling." Mr. G. A. Cowles.

Notes

The Next I.M.E.A. Convention

The preliminary programme of the forty-first annual convention of the Incorporated Municipal Electrical Association appears in the January issue of the *I.M.E.A. Journal*. The convention takes place in Edinburgh from June 8th to 12th under the presidency of Mr. E. Seddon, M.I.E.E., electrical engineer and manager of that city. The papers to be read include one on "Electric Water Heating," by Mr. G. H. Lake, M.I.E.E., city electrical engineer of Nottingham; another on "Heavy Duty Electric Cooking," by Mr. S. C. Hurry, of the Jackson Electric Stove Co., and Mr. W. E. Swale, A.M.I.E.E., of the Manchester Corporation Electricity Department; and a third on "Electric Street Lighting," by Mr. P. J. Robinson, M.I.E.E., of Liverpool, and Mr. J. N. Waite, M.I.E.E., of Hull.

Dual Control of Machinery

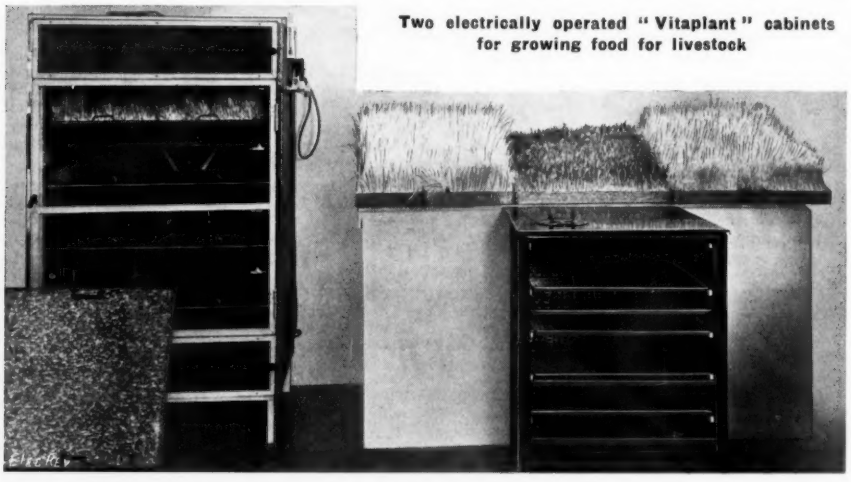
A system of dual control of pithead machinery was criticised at an inquiry at Dunfermline on December 19th into the death of a colliery screening plant attendant which occurred at the screening plant at Bowhill Colliery of the Fife Coal Co., Ltd., from injuries caused by his being crushed by one of the tippers when he was repairing it. It was explained in evidence that the tipper was a large drum in which hutches of coal were rotated. The machine could be actuated by a worker at the screening tables, and also by the wagon trimmers underneath. The tipper had been stopped by a pithead worker to allow the deceased to make a small repair, and after he had entered the tipper it was again set in motion by the other control, and the attendant was fatally injured. The manager of the colliery stated that there had been no accidents previously owing to the dual operation of the controls. He said that if the tipper had been left in the normal position it would have remained stationary all the time, supposing either of the controls had started. He thought the attendant made an error of judgment in the way he went about the job. Mr. Robert Shirkie, of the Scottish Colliery Engine and Boilermen's Association, who appeared for the representatives of the deceased, asked the jury to find that the system of independent dual control was not safe. The Sheriff said the jury might say that they were of opinion that the system by which the tippers could be started or stopped by two people at different places independently of each other, and without the one being cognisant of what the other was doing, was *prima facie* unsatisfactory. The jury acquiesced in his Lordship's suggestion.

Vertical Cables

At a recent meeting of the Paisley Association of Electrical Engineers a lecture was given by Mr. S. Winstanley on "Paper Cable Manufacture," with particular reference to cables of 20,000 V. Mr. Winstanley dealt with a three years contract for supplying and installing 20,000 V paper cables specially manufactured for vertical suspension in the Rand Mines in South Africa, and slides were shown depicting the methods employed in executing this important job.

Up-to-date Livestock Feeding

It is a well-known fact that all classes of livestock are in their best condition in the spring when the fodder possesses a certain quality lacking at other seasons. To provide a succulent fresh plant food all the year round as an efficient substitute for spring fodder, British Cultivations, Ltd., 14, Regent Street, London, S.W.1, are now marketing the "Vitaplant" germinating cabinet, which in six days produces 6 in. of green fodder from seed. The cabinet consists of six compartments which are seeded on successive days so that a cabinet in full use has six crops in successive stages of growth. As each crop reaches maturity it is taken out and, after cleaning, the compartment is refilled with fresh seed. The cabinet is kept at a constant temperature by a plate type electric heater in the base, the seeds being twice daily automatically flooded with water containing "Nutrisal," a chemical nutriment. The grain is soaked in water for 24 hours before being put into the cabinet. As far as possible all working parts are automatic, and the daily work, which can be done by an ordinary farm labourer, takes from 60 to 90 minutes. Any seeds, cereal or legume, may be grown and, as an example of the economical running costs, a ton of sprouted maize costs about £2 2s. (inclusive of all overhead charges). Two models of the cabinet are at present available, the standard (capacity 480 lb.) and the "Junior" (240 lb.).



Two electrically operated "Vitaplant" cabinets for growing food for livestock

Railway Switch Heating

Following tests made in recent years, says the *Nickel Bulletin*, the Italian State Railways have now completed the installation of an electric heating system for 1,206 switches in the Milan Central Station yards, to melt snow and ice in severe weather. Nickel-chromium electrical resistance wire and malleable nickel wire contacts are used.

Appointments Vacant

Civilian technical officer for the Department of Scientific Research, Admiralty.

Scientific officer, junior scientific officer and assistants, Grades II and III, for the Directorate of Scientific Research, Air Ministry.

Assistant sub-station attendant for Hove Corporation Electricity Department.

Station superintendent for Stepney Borough Council.

Civilian wireless instructors for the Air Ministry.

Assistant mains engineer for the Chester Electricity Department.

Wireless inspector in the Posts and Telegraphs Department of the Sudan Government.

Assistant electrical engineer for the Hawarden R.D.C.

Examiners in the w/t section of the Air Ministry (Aeronautical Inspection Directorate).

Two assistant operating engineers for Fulham Borough Council.

Works chemist for Halifax Electricity Department.

(See our classified advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

New Year Honours.—We give below the names of the gentlemen (and one lady) connected with electrical or allied interests whose names were included in the Honours List published on Wednesday last:—**Mr. T. Biggart,** formerly secretary to the Shipbuilding and of the Engineering Employers' Federations, receives a knighthood. **Mr. T. R. Gardiner,** Deputy Director-General, G.P.O., becomes a K.B.E. The O.B.E. has been awarded to **Mr. C. J. Mercer,** M.I.E.E., staff engineer, headquarters, Engineering Department, G.P.O., **Mr. A. G. Dryland,** M.C., engineer-in-charge, London station, B.B.C., **Capt. L. P. Gill,** assistant engineer, Engineering Department, Northern Ireland District, G.P.O., and **Miss E. M. Mahlendorff,** superintendent, London Telephone Service, G.P.O. In the India Office list, the C.S.I. is awarded to **Mr. W. H. Thompson,** M.L.C., director of the Bengal Telephone Corporation, Ltd. **Mr. E. P. Burke,** chief engineer and secretary to the Government of Assam in the Public Works Department, **Mr. H. A. Hyde,** M.C., chief engineer, Public Works Department (Buildings and Roads and Irrigation Branches), Central Provinces, and **Mr. C. D. Rae,** O.B.E., Posts and Telegraphs Department, Postmaster-General, Bombay, receive the C.I.E. The O.B.E. is awarded to **Mr. C. B. Sethna,** station director, Indian State Broadcasting Service, Bombay, and **Mr. F. T. Jones,** C.I.E., M.V.O., superintending engineer, Central Public Works Department, Delhi, receives the Kaisar-i-Hind medal.

Mr. H. C. Van de Velde, who entered upon his duties as managing director of the Marconi International Marine Communication Co., Ltd., on January 1st, has been associated with the Marconi Companies for the last sixteen years, having joined the Aircraft Department of Marconi's Wireless Telegraph Co., Ltd., when that department was formed in 1919. He was made joint sales manager of the Marconi Co. in July, 1929; assistant general manager in January, 1932; deputy general manager in January, 1934; and general manager in August, 1935. He succeeds Mr. F. S. Hayburn, who, as we reported in our issue of December 13th, page 836, has been appointed foreign envoy of the Marconi group of companies. Mr. Van de Velde, who is a native of Brighton, enlisted in the Royal Flying Corps in 1915, and served in France in 1916 and 1917. Later he was transferred to Biggin Hill and Farnborough as instructor in wireless telegraphy. In 1918 he was appointed chief wireless officer to the Canadian Air Force, and retained that position until demobilisation in July, 1919, when he joined the Marconi Co. as an aircraft wireless engineer and had much to do with the initial organisation of wireless communication on the commercial air routes between England and the Continent. In this capacity he was responsible for the building of the wireless station at the London Airport, Croydon. He remained with the Aircraft Department of the Marconi Co. until his appointment as joint sales manager in 1929. He is a director of the Marconi-E.M.I. Television Co., the Marconi Code Co., Marconi Espanola S.A. (Spain), Radio Slavia (Czechoslovakia), and Polskie Zaklady Marconi S.A. (Poland).

Mr. H. C. Van de Velde

Mr. E. S. Carling has resigned his directorship of Messrs. Wood & Carling, Ltd., and has joined the staff of the National Electrical Supplies Co., Ltd. Mr. Carling has been connected with the electrical industry for many years; he was South Coast and West of England representative for sixteen years with the late Electrical Co., Ltd., of Charing Cross Road, W.C.2. After the War he represented the General Electric Co., Ltd., for a number of years, and started Messrs. Wood & Carling in 1924.

While there has been no sign that the President of the United States proposes to utilise the lengthy practical experience of **Mr. Samuel Insull** in connection with his national power policy, there is a possibility that, in spite of his seventy-six years, Mr. Insull may "stage a come back" in another branch of electrical enterprise. According to *Reuter*, it is understood that he will be the head of a chain of wireless stations in the Middle West (the Affiliated Broadcasting Co.), for which a capital of £20,000 has been subscribed by friends. Mr. Insull neither confirms nor denies the report, but promises a statement later.

Mr. J. Andrews, of Messrs. Woodhall & Partners (1929), Ltd., was married on December 18th to Miss Sian Chubb-Jones.

Monsieur J. F. Joliot and **Madame Joliot** (née Curie), both of the Faculty of Science, Paris, have recently been appointed Chevaliers of the French Legion of Honour as a mark of appreciation of their work in connection with scientific development.

Mr. F. Morgan, author of the article on "Conversion to Public Supply" (page 8), was educated at the City of Leeds School and Leeds University (1921 to 1924), receiving his early training with the Leeds Engineering & Hydraulic Co., Ltd. Subsequently he served under the Corporation, and in 1927 joined the staff of the West Midlands Joint Electricity Authority, being engaged in the design of the Ironbridge power station.

In 1930 he was transferred to the distribution staff as surveyor, and for the past two years he has assisted the distribution engineer in connection with power sales. Mr. Morgan is an associate member of the Institutions of Electrical and Civil Engineers.

[*Bennett Clark, Wolverhampton*

Mr. F. Morgan

Mr. F. G. C. Baldwin, superintendent engineer at the General Post Office, Newcastle-on-Tyne, who has been appointed chief regional engineer at Leeds, has been presented with several gifts by the staff at Newcastle. The presentations were made to Mr. Baldwin by Mr. W. V. Greenwood, on behalf of the Post Office Engineering Union, and by Captain Fletcher, on behalf of the district headquarters staffs. Mr. W. Atkins, of the local staff, made a presentation to Mrs. Baldwin.

Mr. R. G. Flanagan, cooker representative for Carron Company in Yorkshire, has now been appointed special cooker representative for the northern area, including Yorkshire, Lancashire and Northern England, as from January 1st.

Mr. C. T. A. Moses has been appointed general manager of the Australian Broadcasting Commission at a salary of £2,000 a year. He succeeds Mr. W. T. Conder, who resigned in June. Mr. Moses was born at Atherton, Lancashire, and went to Australia in 1927, joining the Melbourne staff of the Australian Broadcasting Co. in 1930.

Mr. A. Haze, of Blackpool Corporation transport engineering department, who has retired on superannuation after sixteen years' service, has been presented with a cut glass trinket set and smoker's outfit by his colleagues.

Mr. H. H. Weenen has retired from the board of Wiring, Ltd.

Mr. J. G. Shaw, joint founder of the original Crypto Electrical Co., Ltd., and joint managing director of Lancashire Dynamo & Crypto, Ltd., has retired from active management of the company but will remain on the board. This will enable him to devote more time to his various directorships, particularly that of the new subsidiary company, Crypton Equipment, Ltd., of which he will be the chairman. Mr. Shaw started with the former Crypto Works, Co., Ltd., in 1895, when the chief product was the "Bantam" bicycle. Running in connection with this product was a department manufacturing small electric dynamos and motors, of which Mr. Shaw was appointed manager in 1896, a position which he held until 1904, when he and his brother, Mr. C. R. Shaw, purchased the assets and formed the Crypto Electrical Co. The business grew rapidly, and in 1912 an extensive site was bought in Willesden where the first part of the present modern factory was erected. During the war the business was under Admiralty control, and in 1920 the Crypto Electrical Co., Ltd., became associated with the Lancashire Dynamo & Motor Co., Ltd.,

[*Elliott & Fry*

Mr. J. G. Shaw

Trafford Park, Manchester, which resulted in complete amalgamation under the title of Lancashire Dynamo & Crypto, Ltd., in January, 1932.

Mr. E. A. Logan, resident engineer at Cockermouth for the Mid-Cumberland Electricity Co., Ltd., who is leaving to take up a position at Erith, has been presented by the staff and employés with an electric chiming clock and a set of game carvers. **Mr. L. V. Packham,** assistant engineer at Penrith, who was recently married, has been given a bookcase by the staff at Leeds. Both presentations were made at a dinner held recently at Cockermouth and presided over by Mr. S. R. Siviour, of Leeds.

Mr. E. J. Cripps, of the Wallace Electrical Co., and his family, are spending a holiday in the Austrian Tyrol.

At the December meeting of the National Joint Industrial Council for the Electricity Supply Industry a resolution was adopted expressing high appreciation of the many years of useful work by **ex-Alderman R. Richardson,** of Hull. **Alderman Sir Percy Bower** was elected to the vacancy on the Negotiating Committee caused by the ineligibility of Mr. Richardson.

Mr. J. K. Winser is relinquishing his present position as head of the Technical Department of the Building Centre to take up an appointment with Messrs. O. W. Roskill, industrial consultants. He will retain his connection with the Centre by becoming technical consultant.

Mr. P. P. Wheelwright, M.I.E.E., has been appointed to act as technical representative of Electricars, Ltd., in London and the Home Counties. He will chiefly devote his attention to electricity undertakings. His address will be 81, Queen Victoria Street, E.C.4. **Mr. G. Wakeham** has been appointed as the company's representative for Scotland, at 93, Hope Street, Glasgow, C.2.

Consequent upon the retirement of **Mr. J. Cusworth** as head of the Operation Department of the North-Eastern Electric Supply Co., Ltd., **Mr. A. A. Hughes** has been transferred from the Electrical Section of the Construction Department to take charge of the operation of the company's system so far as concerns transmission and distribution, and **Mr. H. Cresswell** has succeeded to the appointment vacated by Mr. Hughes, whilst **Mr. W. Innes** has become responsible for all matters relating to generation.

Obituary

The Marquess of Reading, who died on December 30th, was chairman of the Palestine Electric Corporation, Ltd.

Mr. E. W. Rice.—We learn from the *Electrical World* of the death of Mr. Edwin Wilbur Rice, Jun., which occurred at Schenectady on November 25th, at the age of seventy-three. Mr. Rice became assistant to Elihu Thomson in Philadelphia fifty-six years ago, and later was associated with the American Electric Co. In 1882 he went to Lynn, Massachusetts, where he worked for three years with Mr. Thomson as experimenter and inventor on arc lighting systems. He became superintendent of the works of the Thomson-Houston Electric Co. in 1885, and upon the consolidation of the Edison General Electric Companies and the Thomson-Houston Co. in 1892 he was appointed technical director. In 1896 he was made a vice-president of the General Electric Co., and upon the retirement of Mr. Coffin in 1913 he was elected president, becoming honorary chairman of the board of directors in 1922. Mr. Rice supported the research and development that made the polyphase motor and a.c. system available. He was instrumental in developing the steam turbine, and was an advocate of railway and marine electrification. His inventive ability was shown in his 100 patents. The establishment of the research laboratory owed its inception to him and he realised its value, although it was then unique in industry. Mr. Rice was a Chevalier of the Legion of Honour, past-president of the American Institute of Electrical Engineers, member of many professional societies, and an officer in many corporations.

Mr. E. Longbottom.—We regret to learn of the death, following an operation for appendicitis, of Mr. Ernest Longbottom, a partner in the firm of Milne & Longbottom, electrical engineers, Rochdale. Mr. Longbottom received his early training with Messrs. Whipp & Bourne, Ltd., and commenced business in partnership a few years ago. He was honorary secretary of the Rochdale branch of the E.C.A.

Mr. H. S. Naylor, who died on December 17th, at the age of fifty-four years, was principal of Messrs. J. Naylor & Son, electrical engineers and contractors, of 3, Peter Lane, York. He took over the business from his father at the age of twenty-one, and carried out many important contracts in the city.

Mr. G. W. Lenz.—The death has occurred at Johannesburg of Mr. George William Lenz, a director of Messrs. Reunert & Lenz, Ltd., electrical and general engineers, and of Messrs. Reynolds, Sons & Partners, Pty., Ltd. Mr. Lenz was born in Johannesburg, and after serving overseas in the War he graduated at Trinity College, Cambridge.

Signor C. Feltrinelli.—The death recently occurred in Milan, at the age of fifty-four years, of Signor Carlo Feltrinelli, the president of the Società Edison, the largest electricity supply undertaking in Italy.

We tender our deep sympathy to **Mr.** and **Mrs. W. R. Rawlings** in the bereavement that has befallen them—their only daughter, Mrs. H. J. Fremantle, died on December 28th at 106, Home Park Road, Wimbledon Park. We feel that in doing so we are voicing the sentiments of many readers of the ELECTRICAL REVIEW.

Will.—Mr. S. S. Frankenburg, a director of the Greengate & Irwell Rubber Co., left £100,005, "so far as can at present be ascertained," with net personalty of £78,895.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Flexaire Heaters, Ltd.—Private company. Registered December 21st. Capital, £5,000 in £1 shares. Objects: To carry on the business of heating, lighting, electrical, hydraulic, automobile and general engineers, &c. The directors are: C. S. Lewis, Millgrove, Woodlands Drive, East Horsley, and two others. Secretary: W. R. Clemens. Registered office: 149, Lupus Street, London, S.W.1.

Erren Apparatus, Ltd.—Private company. Registered December 27th. Capital, £100 in £1 shares. Objects: To carry on the business of mechanical, electrical and general engineers, &c. The subscribers are: W. L. Baker, 46, Malden Avenue, London, S.E.25; and G. A. Smith, 17, Waverley Road, South Woodford. Solicitors: Allan & Overy, 3, Finch Lane, London, E.C.3.

Stephen Williams, Ltd.—Private company. Registered December 28th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets, accessories and apparatus, &c. S. Williams, of 8, Cardiff Road, Caerphilly, Glam, is permanent managing director.

Watson & Miller, Ltd.—Private company. Registered December 28th. Capital, £500 in £1 shares. Objects: To carry on the business of illuminated sign manufacturers, electricians and mechanical engineers, suppliers of electricity, &c. The directors are: E. L. Watson (chairman), Queen's Mead, Hartburn, Stockton-on-Tees; and H. E. Miller, 2, Lindon Avenue, Stockton-on-Tees. Secretary: H. E. Miller. Registered office: 24, Prince Regent Street, Stockton-on-Tees.

Modern Labour Savers, Ltd.—Private company. Registered December 27th. Capital, £900 in £1 shares (800 "A" and 100 "B"). Objects: To carry on the business of designers, manufacturers, exporters and importers of and dealers in electrical and gas apparatus and appliances, &c. The directors are: J. M. Fairhurst, 21, Dumber Lane, Sale, Ches.; and W. S. Kay, 71, Claude Road, Chorlton-cum-Hardy, Manchester. Solicitors: Grundy & Jackson, 196, Deansgate, Manchester.

Richard Savage, Ltd.—Private company. Registered December 27th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of machines, appliances and apparatus, electrical and otherwise, &c. The directors are: M. Trachtenberg, 140, Bridge Lane, London, N.W.11; and L. Berman, 90, Canfield Gardens, London, N.W.6. Solicitor: H. Snowman, 6, Billiter Street, London, E.C.3.

Selby Public Address, Ltd.—Private company. Registered December 19th. Capital, £200 in £1 shares. Objects: To carry on the business of radio, electrical, automobile, television, public address and general engineers, &c. The directors are: D. F. Green, 32, Chalgrove Avenue, Morden, Surrey; and J. B. Smetzer, 53, Foxearth Road, Selsdon, South Croydon. Registered office: 53, Foxearth Road, Selsdon, South Croydon.

Argyle Accumulator Co., Ltd.—Private company. Registered in Edinburgh, December 20th. Capital, £2,500 in £1 shares. Objects: To carry on the business of makers of and dealers in electrical and/or chemical appliances and goods of all kinds, &c. The directors are: M. M. W. Smith, 2, Milner Road, Jordanhill, Glasgow, W.3, S. Macpherson, 180, Berkeley Street, Glasgow, C.3, and two others. Registered office: 1027, Argyle Street, Glasgow, C.3.

Tyburn Radio and Electrical Co., Ltd.—Private company. Registered December 21st. Capital, £500 in £1 shares. Objects: To acquire the business of a radio apparatus dealer carried on by L. J. Palmer at 997, Tyburn Road, Pype Hayes, Birmingham, and to carry on the business of manufacturers of and dealers in gramophones, cameras, electric accumulators and batteries, &c. The subscribers are: L. J. and I. M. Palmer, 29, Westbourne Ave., Hodge Hill, Birmingham. Registered office: 997, Tyburn Road, Pype Hayes, Birmingham.

Sunshine Devices, Ltd.—Private company. Registered December 19th. Capital, £1,000 in 500 8 per cent. preference shares of £1 and 5,000 ordinary shares of 2s. Objects: To carry on the business of manufacturers of and dealers in illuminating appliances of all kinds, electrical installation contractors, engineers, manufacturers of and dealers in electrical apparatus, &c. The permanent directors are: E. Bennett, 25a, Falkner

Square, Liverpool, and L. Keith, 49, Dewsbury Road, Liverpool, 4. Registered office: 57, Moorfields, Liverpool.

Dagnalls (Radio & Electrical), Ltd.—Private company. Registered December 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical, radio, mechanical and general engineers and contractors and radio and electrical retailers carried on by S. Dagnall, Ltd. (in voluntary liquidation), at 420, Stratford Road, Sparkhill, Birmingham. The subscribers are: R. S. J. Dagnall, 1532, Stratford Road, Hall Green, Birmingham, and L. J. Biddle, 39, Warwick Road, Olton, near Birmingham. Manager: R. S. J. Dagnall. Registered office: 420, Stratford Road, Sparkhill, Birmingham.

P. D. Morris, Ltd.—Private company. Registered December 21st. Capital, £6,000 in £1 shares. Objects: To acquire the business of electrical engineers and contractors and all or any of the assets of the firm of P. D. Morris, of 28 and 30, High Street, Islington, N., and at Barnett Wood Lane, Ashtead, Surrey. The directors are: P. D. Morris, 51, Harlech Road, N., and E. E. Morris, 3, Church Road, Ashtead, Surrey. Secretary: F. E. Morris.

Holy Trading Co., Ltd.—Private company. Registered December 21st. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, wireless and television engineers, manufacturers of scientific instruments, &c. The directors are: E. Heimann, 9, Alba Gardens, Golders Green, N.W.11, and two others. Registered office: Finsbury Court, 111, Finsbury Pavement, E.C.2.

Returns of Electrical Companies

General Resistors, Ltd.—Capital, £8,000 in 3,000 preference and 5,000 ordinary shares of £1. Return dated October 2nd, 1935. 2,789 preference and 3,452 ordinary shares taken up. £6,239 paid, £2 calls unpaid. Mortgages and charges, nil.

Superfrigor Manufacturing Co., Ltd.—Satisfaction in full on December 13th, 1935, of mortgage dated July 9th, 1934, and registered July 16th, 1934. (According to the register of mortgages the only deed registered July 16th, 1934, was a charge which originally secured all moneys due to bank not exceeding £2,500.) Mortgage on freehold land, factory and other buildings in Ealing, W., abutting on Aintree Road, dated December 13th, 1935, to secure £3,000. Holders: J. H. Downey, 5, Clifford Street, W., and S. H. Olver, 42, Devonshire Street, London, W.1.

Patterson Lamps, Ltd.—Capital, £10,000 in £1 shares. Return dated August 6th, 1935. 6,330 shares taken up. £6,330 paid. Mortgages and charges: £1,950.

Warrington Electric Cables, Ltd.—Capital, £15,000 in £1 shares. Return dated September 24th, 1935. 10,000 shares taken up. £10,000 paid. Mortgages and charges nil.

Chadburns (Ship) Telegraph Co., Ltd.—Capital, £120,000 in £1 shares (60,000 preference and 60,000 ordinary). Return dated September 18th, 1935. All shares taken up. £100,000 paid on 50,000 preference and 50,000 ordinary. £20,000 considered as paid on 10,000 preference and 10,000 ordinary. Mortgages and charges nil.

Glynceiriog Electricity Supply Co., Ltd.—Capital, £1,500 in £1 shares. Return dated September 26th, 1935. 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges nil.

Watliff Co., Ltd.—Capital, £10,000 in 7,000 preference and 3,000 ordinary shares of £1. Return dated August 29th, 1935. 6,100 preference and 3,000 ordinary shares taken up. £8,980 paid on 6,100 preference and 2,880 ordinary shares. £120 considered as paid on 120 ordinary shares. Mortgages and charges: £4,500.

Metropolitan Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £500,000, in £1 ordinary shares, beyond the registered capital of £3,000,000.

L.P.S. Electrical Co., Ltd.—The nominal capital has been increased by the addition of £15,000. in £1 ordinary shares, beyond the registered capital of £5,000.

Landis & Gyr, Ltd.—The nominal capital has been increased by the addition of £50,000 in £1 ordinary shares beyond the registered capital of £150,000.

Richmond (Surrey) Electric Light & Power Co., Ltd.—The nominal capital has been increased by the addition of £200,000 in £1 ordinary shares beyond the registered capital of £200,000.

Electricity Distribution of North Wales & District, Ltd.—The nominal capital has been increased by the addition of £194,500 in £1 ordinary shares beyond the registered capital of £205,500. The 200,000 preference shares of £1 in the original capital are to be known as ordinary and the 110,000 ordinary shares of 1s. are to be consolidated into 5,500 ordinary shares of £1 each.

Pennington, Stevens & Taylor, Ltd.—Capital, £7,000 in £1 shares. Return dated October 9th, 1935. 6,912 shares taken up. £6,762 paid, £150 considered as paid. Mortgages and charges, nil.

Sellers of Leeds, Ltd.—Capital, £12,000 in 4,000 preference and 8,000 ordinary shares of £1. Return dated September 6th, 1935. 3,000 preference and 5,000 ordinary shares taken up. £2 paid, £7,998 considered as paid. Mortgages and charges, nil.

H. Church & Co. (Essex), Ltd.—Capital, £7,000 in £1 shares. Return dated October 7th, 1935. 6,458 shares taken up. £6,458 paid. Mortgages and charges, nil. A further 150 shares were allotted for cash on October 28th, 1935.

Economic Electric Co. (Liverpool), Ltd.—Capital, £10,000 in £1 shares. Return dated October 29th, 1935. 8,300 shares taken up. £8,300 considered as paid. Mortgages and charges, £3,920.

Ellison Insulations, Ltd.—Capital, £15,000 in £1 shares. Return dated October 31st, 1935. All shares taken up. £10,800 paid. £4,200 considered as paid. Mortgages and charges, nil.

Electric Welders (Slough), Ltd.—Capital, £2,000 in £1 shares. Return dated October 22nd, 1935. 1,050 shares taken up. £800 paid. £250 considered as paid. Mortgages and charges, nil.

Electric Resistance Furnace Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 3rd, 1935. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Electric Radiators, Ltd.—Capital, £1,000 in £1 shares. Return dated October 17th, 1935. 260 shares taken up. £245 paid. £15 considered as paid. Mortgages and charges, nil.

Insulations & Constructions, Ltd.—Capital, £2,000 in £1 shares. Return dated October 10th, 1935. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Neron Lamps, Ltd.—Capital, £5,000 in £1 shares. Return dated October 21st, 1935. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Gladwell & Cook, Ltd.—Capital, £500 in £1 shares. Return dated October 9th, 1935. All shares taken up. £500 paid. Mortgages and charges, nil.

Rich & Bundy, Ltd.—Capital, £1,000 in £1 shares. Return dated October 24th, 1935. All shares taken up. £407 paid, £593 considered as paid. Mortgages and charges, nil.

H. C. Baker, Ltd.—Particulars filed of £500 debentures, authorised December 17th, 1935, charged on the company's property, assets and undertaking, including uncalled capital, the amount of the present issue being £450.

Lewtas's, Ltd.—F. J. Connor, 3, York Street, Manchester, ceased to act as receiver and manager on December 7th, 1935.

City Notes

The Chiswick Electric Supply Corporation, Ltd., held an extraordinary meeting on December 30th at which a resolution was passed approving a preliminary agreement for the sale and purchase of the Aberystwyth undertaking to the Aberystwyth Corporation. This provides that the purchase price is to be ascertained by two valuers, one appointed by the company and the other by the local authority, and if the valuers are unable to agree the matter will be submitted to arbitration. It is not yet possible to state the amount receivable by the company, but the directors are of opinion that, on the basis of this provisional settlement and subject to the realisation of the investments still held by the company, the ultimate return on each share now outstanding (of the nominal value of 2s.) will be approximately 23s. When the sale of the Aberystwyth undertaking has been completed the company will probably be liquidated.

Companies struck off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Car-Radios, Ltd.; Co-Radio, Ltd.; Cordo Electrical Products, Ltd.; Friar Radio Co., Ltd.; New North Radio, Ltd.; Rayfac Radio, Ltd.

Companies to be struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary: A.E.G. Electrical Co., of South Africa, Ltd.; Adey Radio, Ltd.; Bloomsbury Wireless Co., Ltd.; Duophone (Foreign), Ltd.; Electricity Finance & Distribution Corporation, Ltd.; Gramo-Radio Amplifiers, Ltd.; Halcyon Wireless Co., Ltd.; Sphinx Electric, Ltd.; Sun-Ray Electric Lamp Co., Ltd.

Stocks and Shares

NEW YEAR'S EVE, 1935.

THE wishes expressed twelve months ago for a prosperous New Year have materialised, in a good many cases, for the holders of Stock Exchange securities that are connected in any way with the electrical industry. The past twelve months have shown notable expansion in branches that were already progressing.

This time last year the London electricity supply companies were working individually in their own areas. By amalgamation of the majority, not only have economies been secured, but the closer co-operation has enabled a variety of improvements to be introduced. From the point of view of the electricity supply market, this amalgamation, under the name of the London Associated Electricity Undertakings, Ltd., stands out as being one of the features of the year. Of the few companies that remain as separate entities, the County of London and the Metropolitan are two of the chief. A year ago County of London shares stood at 57s. and Metropolitans at 54s. 6d. The current prices are lower by 3s. and 2s. 6d. respectively. London Associated Electricity shares are quoted at 35s., which would compare with the various quotations, ranging from 36s. to 37s., which ruled twelve months ago for the prices of the shares in the then individual companies.

Provincial and Scottish

In the list of provincial companies it is possible to make more precise comparisons. From the following table it will be noticed that the variations, except in a few cases, are comparatively slight. Of the shares in the two Scottish companies, Clyde Valley are better; Scottish a little lower, on balance. Here are the comparative figures:—

Ordinary shares.	Dec. 30, 1933.	Dec. 31, 1934.	Dec. 31, 1935.	Rise or Fall.
Bournemouth & Poole	78/3	78/9	77/6	— 1/3
Clyde Valley	41/3	41/6	44/6	+ 3/–
Elec. Dis. Yorkshire	47/6	50/–	46/–	— 4/–
Lancs Light & Power	35/–	38/6	38/–	— 6d.
Midland Counties	38/9	38/6	39/–	+ 6d.
Midland Elec. Power	45/–	47/6	41/3	— 6/3
North Eastern	35/6	33/6	34/–	+ 6d.
Northampton	55/–	57/6	51/3	— 6/3
Scottish Power	41/3	43/–	42/6	— 6d.
Yorkshire Elec.	47/6	48/–	45/–	— 3/–

The past year has seen a considerable volume of business in the shares of these companies. By reason of the amalgamation of the London undertakings, the attention of the investor has been more actively diverted towards the provincial group,

the shares in which are becoming spread amongst a constantly widening circle of investors.

Gilt-edged Stocks

Prices of most gilt-edged stocks have moved, on balance, towards slightly lower levels. This is not due to the fact of money having become any dearer, but rather to the lavish outpouring of new securities that went on for a great part of the year. Occasion has been taken in these columns to reflect the surprise frequently heard in the City at the ready manner in which new issues of substantial amounts are absorbed. Money remains as cheap as ever, but the amount of stock—more particularly in the gilt-edged market—available for public investment has greatly swollen. The electricity authorities' stocks have scarcely felt the effect of this accession of new issues. London Passenger "B" is 2 points up, although the "A" stock shows a similar decline. The "C" stock at 108 is 8 points better on the year. Central Electricity issues stand at much the same prices as they did a year ago.

Cable and Wireless

The greatly improved status of Cable and Wireless, as shown in the increase of the dividend on the preferred stock from 2¾ per cent. to 4⅛ per cent., has resulted in the price of this stock rising from 83 to 106. The "A" at 28½ is 10 points higher on the year; the "B" is 1 up. In consequence of this, Globe ordinary shares, which were 11¼ this time last year, are now 15½. Hopes are entertained of the combine being able to meet its full 5½ per cent. dividend in the current twelve months. The following table gives details of the actual quotations :—

Stock or share.	Dec. 30, 1933.	Dec. 31, 1934.	Dec. 31, 1935.	Rise or Fall.
American Tel. & Tel.	109½	106¾	155	+ 48¼
Anglo-American pref.	114	122	124½	+ 2½
Cable & Wireless pref.	73½	83	106	+ 23
Cable & Wireless "A"	23	18½	28½	+ 10
Cable & Wireless "B"	10½	7	8	+ 1
Globe ordinary	10	11¼	15½	+ 4¼
Great Northern	32½	38	40	+ 2
International Tel. & Tel.	12½	8½	13	+ 4½
Marconi Marine	30/–	33/9	36/3	+ 2/6

It will be noticed that American Telephone and Telegraph stock has risen 48¼ points, while International Telephone and Telegraph shares are 4¼ higher. Business conditions in America have improved considerably upon those which obtained this time last year. Moreover, the war between Italy and Abyssinia, greatly as it is deplored, has had the effect of increasing the traffics of the communication companies. From the point of view of world progress, it would have been far better had the messages been concerned with industrial and business relations, rather than with military matters.

Manufacturing and Equipment

The manufacturing and equipment group is noteworthy, more especially for the very substantial rise that has occurred in the price of Crompton Parkinsons. The number of fortunes that have been missed by people not having bought Cromptons at 36s. a year ago, and selling them at 125s. on this New Year's Eve, must be extremely large. The meteoric jump of £4 9s. per share has been due to the remarkable advance made by the company, as evidenced by the recently issued report, and the bonus issue of shares. The manufacturing and equipment group as a whole has proved to be very magnetic to the investor: his money has poured liberally into the best-class issues in this group. Some of the principal movements are set out in this table :—

Ordinary shares.	Dec. 30, 1933.	Dec. 31, 1934.	Dec. 31, 1935.	Rise or Fall.
Babcock & Wilcox	40/–	45/–	52/–	+ 7/–
British Aluminium	27/3	28/9	43/9	+ 15/–
British Insulated	3⅜	77/–	5	+ 23/–
Callender's	3 1/16	3 7/16	3⅞	+ 1/16
Enfield Cables	4⅛	4 1/16	5⅛	+ 1/16
G.E.C.	42/6	50/–	73/–	+ 23/–
Henleys	6½	6 13/16	7 1/16	+ ¼
Johnson & Phillips	18/9	28/3	48/9	+ 20/6
Siemens	20/–	20/–	26/3	+ 6/3

A Prosperous New Year

The main disappointment of the year's work is connected with the stocks and shares in companies operating abroad. The Argentine Republic, Brazil and Mexico have afforded cold comfort to the proprietors of stocks and shares in companies situated in these countries. The difficulties of foreign exchange have militated against revival of confidence and have, thereby, compelled interest to turn to the more domestic companies. British Electric Traction ordinary stock has shared the honours with Crompton Parkinson, so far as our price lists are concerned. At 1500, the current quotation shows a gain of 600 points on the year. In the overseas group, Victoria Falls Power ordinary shares have gone ahead, on the bonus distribution of shares. South Africa, owing to the flourishing condition of the gold industry, is to-day a popular medium for the investment of British capital. Stock Exchange markets finished the old year upon a very cheerful note. Prices were strong in most departments and members of the House looked forward to returning on Thursday in this week to active business. It is, fortunately, no conventional wish—thanks to the favourable prospects which now prevail—when the hope is expressed that the New Year may bring prosperity and well-being to those who are patient enough to follow these weekly paragraphs on stocks and shares.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Dec. 31.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3⅞	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 0
Clyde Valley	1	7	8	44/6	+6d.	3 11 6
County of London	1	10½	10½	54/–	—	3 17 9
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	7	8	43/6	—	3 13 7
Elec. Dis. Yorkshire	1	9	9	46/–	—	3 18 3
Elec. Fin. and Securities	1	12½	12½	3 7/16	—	3 12 9
Elec. Supply Corporation ...	1	11	11	3½	—	3 10 8
Lancs Light and Power	1	7½	7½	38/–	—	3 19 0
Lond. Assoc. Electric	1	—	—	35/–	—	4 0 0
London Electric	1	7	8	39/–	—	4 2 0
London Power deb. Red.... ...	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	52/–	—	3 17 0
Midland Counties	1	7	7	39/–	+6d.	3 11 9
Mid. Elec. Power	1	8	8	41/3	—	3 17 6
North Eastern Electric Ordinary	1	6	6	34/–	—	3 10 7
Do. 7% Pref. ...	1	7	7	35/–	—	4 0 0
Northampton	1	10	10	51/3	—	3 18 0
Notting Hill 6% Pref.	10	6	6	14½xd.	—	4 2 9
North Met. Elec. Ordinary ...	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	42/6	—	3 15 3
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	45/–	—	3 11 0
PUBLIC BOARDS.						
Central Electricity 1950–70 ...	Stock	5	5	116½	+½	4 5 9
Do. 1955–75 ...	,,	5	5	119½	+½	4 3 8
Do. 1951–73 ...	,,	4½	4½	111	—	4 1 1
Do. 1963–93 ...	,,	—	3½	104	+½	3 7 4
London Elec. Trans. Gtd. ...	,,	—	2½	97	—	2 11 8
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 0
London Passenger Transport, A...	,,	—	4½	122½	—	3 13 6
Do. do. B...	,,	—	5	128½	—	3 17 10
Do. do. C...	,,	3½	4	108	—	3 14 1
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	155xd.	—	5 16 2
Anglo-Am. Tel. Pref.	Stock	6	6	124½	+1	4 16 5
Do. Def.	,,	1½	1½	31	+1	4 16 10
Cable & Wireless 5½% Pref. ...	,,	2¾	4⅛	106	—	3 17 10
Do. A. 7½% Ord.	,,	Nil	Nil	28½	–½	—
Do. B. Ord.	,,	Nil	Nil	8	–½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	15½	—	2 5 0
Do. do. Pref.	10	6	6	14⅛	+½	4 3 6
Great Northern Tel.	10	20	20	40	–1	5 0 0
Marconi-Marine	1	10	7½	36/3	—	4 2 9
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1500	+50	—
Do. do. Pref. Ord.	,,	8	8	173½	—	4 12 3
Brazil Traction	100	—	—	10	+½	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	3	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	3⅜	—	—
West Riding	1	5	6½	47/6	—	2 14 9
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	55/–xd.	–5/–	5 9 0
Assoc. Elec. Ord.	1	4	6	43/–	—	2 15 10
Do. Pref.	1	8	8	38/6xd.	—	4 2 8
Babcock & Wilcox	1	6	8	52/–	—	3 1 6
British Aluminium Ord.	1	5	7½	43/9	—	3 8 6
British Insulated Ord.	1	5	15	5	—	3 0 0
Brush Ord.	Stock	Nil	Nil	49	–2	—
Callender's	1	15	15	3⅞	—	3 17 5
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord. ...	5/–	—	12½	6½xd.	+ 1/16	0 8 6
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	32/6	—	2 3 1
Enfield Cable Ord.	1	25	25	5½	+¼	4 10 10
English Electric	1	Nil	Nil	20/–	+6d.	—
Do. do. Pref.	1	Nil	Nil	24/–	—	—
Ericssons Tel.	5/–	—	24	37/6	+ 1/16	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	27/3	—	5 2 9
G.E.C. Pref.	1	6½	6½	33/–	+6d.	3 18 9
Do. Ord.	1	8	10	73/–	—	2 14 10
Henley's	1	30	30	7 1/16	– 1/16	4 5 0
Do. 4½% Pref.	5	4½	4½	5⅞	—	3 16 8
India-Rubber Preferred	1	—	5½	1⅛	—	4 17 9
Johnson & Phillips	1	5	7½	48/9	—	3 1 6
Siemens Ord.	1	6½	4	26/3	– 1/16	3 1 0
Telegraph Construction	£1	Nil	Nil	25/–	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

4761. "Electric carrier signalling systems." General Electric Co., Ltd., N. C. Smart and E. P. L. Westell. January 16th, 1935. (439283.)

6626. "Electrically insulating bodies." A. Nowack Akt.-Ges. and Dr. R. Hessen. March 1st, 1934. (439417.)

6701. "Method of and means for controlling the performance of electric motors." J. Bentley and H. L. Galloway. March 2nd, 1934. (439286.)

15776. "Release mechanism for electric switchgear." Schiele & Bruchsaler-Industriewerke Akt.-Ges. and J. A. Crabtree & Co., Ltd. May 26th, 1933. (439242.)

15847. "Method of evacuating vessels, more particularly lamp bulbs." Astron Akt.-Ges. and Dr. C. Trenzen. December 4th, 1933. (439243.)

16035. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1933. (439288.)

16175. "Cathode-ray apparatus." Marconi's Wireless Telegraph Co., Ltd. May 30th, 1933. (439492.)

16228. "Electric cables." A. W. Williams. May 31st, 1934. (439422.)

16273. "Means for operating impulse electric-clock systems." F. B. M. Gear Syndicate, Ltd., and A. J. Tennison. May 31st, 1934. (439354.)

16537. "Coils for electric ignition apparatus." R. Bosch Akt.-Ges. July 21st, 1933. (439293)

16826. "Mountings for electric motors." British Thomson-Houston Co., Ltd., and T. H. Woodfield. June 6th, 1934. (439427.)

16886. "Appliance for compensating automatic circuit-breakers for temperature variations." Schiele & Bruchsaler-Industriewerke Akt.-Ges. and J. A. Crabtree & Co., Ltd. June 7th, 1933. (439363.)

16945. "Electric motors." British Thomson-Houston Co., Ltd., and A. H. Maggs. June 7th, 1934. (439499.)

16950. "Contact pile-ups for electrical apparatus." Standard Telephones & Cables, Ltd., and R. St. G. Terry. June 7th, 1934. (439500.)

16951. "Self-inductance variometers." C. Lorenz Akt.-Ges. June 30th, 1933. (439501.)

16953. "Electric switches or circuit-breakers." A. Reyrolle & Co., Ltd., H. W. Clothier and A. E. Fawcett. June 7th, 1934. (439502.)

16954. "Electron discharge apparatus and circuit arrangements incorporating the same." Marconi's Wireless Telegraph Co., Ltd. July 24th, 1933. (439503.)

16972. "Counterbalance for suspended electric lamps and other objects." C. A. Riess. June 3th, 1934. (439504.)

17102. "Insulating material for use in electric discharge devices." F. W. Brough. June 8th, 1934. (439511.)

17255. "Electric discharge vessels." Siemens & Halske Akt.-Ges. June 9th, 1933. (439513.)

17453. "Electric fires." N. W. Gibbert and A. E. Jabet. June 13th, 1934. (439515.)

17709. "Fusible electric cut-outs." J. A. Crabtree. June 15th, 1934. (439517.)

17710. "Electric fuses or fusible cut-outs." J. A. Crabtree. June 15th, 1934. (439432.)

18888. "Separation of electrically charged substances from very diluted true or colloidal solutions." H. Fink. June 26th, 1933. (439251.)

19058. "Electric arc atomic hydrogen heating torches." A. L. Guest and Associated Electrical Industries, Ltd. June 27th, 1934. (439520.)

20204. "Low frequency amplifying systems." Standard Radio Relay Services, Ltd., and P. Adorjan. July 10th, 1934. (439307.)

21060. "Method for the production of seamless extruded sheathings of electric cables from metals of relatively high melting points." Siemens-Schuckertwerke Akt.-Ges. July 18th, 1933. (439257.)

22872. "Alternating current electric motors." General Electric Co., Ltd., and J. R. Henderson. August 7th, 1934. (439315.)

22927. "Television or like apparatus." J. L. Baird and Baird Television, Ltd. August 8th, 1934. (439434.)

24336. "Automatic regulation of an electrical supply." British Thomson-Houston Co., Ltd. August 23rd, 1933. (439317.)

24883. "Telephone systems." Siemens Bros. & Co., Ltd., B. A. Hensler, C. L. Peters, W. H. Grinstead and D. A. Christian. (Addition to 412302.) (August 29th, 1934.) (439318.)

25299. "Electric motor controllers." A. West & Co., Ltd., and W. J. Paddock. September 3rd, 1934. (439320.)

25681. "Printing-telegraph receiver." E. E. Kleinschmidt. September 27th, 1933. (439437.)

25945. "Electric thermal switches." C. E. Foster, Wild-Barfield Electric Furnaces, Ltd., and G. H. S. Grene. September 10th, 1934. (439321.)

26833. "Control arrangements for trolley buses." H. K. Ramsden and Associated Electrical Industries, Ltd. September 18th, 1934. (439438.)

27169. "Electric circuit-breakers." Igranic Electric Co., Ltd., and W. F. Grafton. September 21st, 1934. (439383.)

27392. "Dynamo-electric machines." English Electric Co., Ltd., E. A. Binney and A. Southworth. September 24th, 1934. (439439.)

27395. "Automatic telephones and like selective systems." Siemens Bros. & Co., Ltd., H. E. Humphries and R. I. H. Clark. September 24th, 1934. (Addition to 408439.) (439323.)

27659. "Method of and apparatus for observing the nature of a magnetic field." A. M. Armour and Associated Electrical Industries, Ltd. September 26th, 1934. (439324.)

29049. "Radio and like receivers." Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America). October 10th, 1934. (439528.)

29945. "Manufacture of electrical condensers." Dubilier Condenser Co. (1925), Ltd. October 21st, 1933. (439530.)

29946. "Electrolytes for electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. October 21st, 1933. (439531.)

30116. "Electric insulators." British Thomson-Houston Co., Ltd. October 20th, 1933. (439327.)

30958. "Indirectly heated electronic tube." Radio Akt.-Ges. D. S. Loewe. October 30th, 1933. (Addition to 421471.) (439328.)

32302. Apparatus for the electromagnetic separation of materials." R. C. Forrer-Jaggi and Mines Domaniales de Potasse d'Alsace. November 14th, 1933. (Addition to 394471.) (439387.)

32498. "Telephone systems." Siemens Bros. & Co., Ltd., and G. W. Sutton. November 12th, 1934. (439388)

32794 "Gasfilled electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 8th, 1934. (439330.)

33027. "Manufacture of electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. July 6th, 1934. (439533.)

33629. "Electric battery lamps." W. C. Hammond. November 22nd, 1933. (439389.)

34957. "Control systems for electric circuit-breakers and the like." British Thomson-Houston Co., Ltd. December 5th, 1933. (Addition to 30299/34.) (439447.)

36435. "Electric power converting systems." British Thomson-Houston Co., Ltd. December 22nd, 1933. (439331.)

1935

442. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 26th, 1934. (439266.)

1069. "Electric furnaces for heating sheets of glass before tempering." Assurex le Roi des Verres de Securité Magnien Monnier & Cie. January 15th, 1934. (439537.)

4329. "Facsimile printing-telegraph receivers." E. F. Kleinschmidt. February 19th, 1934. (439453.)

5624. "Telephone systems and pay stations for use therein." Telephon Apparat-Fabrik E. Zweitusch & Co., Ges. July 31st, 1934. (439339.)

5775. "High frequency electric cables." Siemens & Halske Akt.-Ges. March 28th, 1934. (439271.)

6561. "Magnetron arrangements and electron-discharge devices for use therein." Telefunken Ges für Drahtlose Telegraphie. March 1st, 1934. (439342.)

6815. "Electrical amplifiers and other control arrangements and devices." O. Heil. March 2nd, 1934. (439457.)

7969. "Oil-filled high-tension electric cables." Felten & Guilleaume Carlswerk Akt.-Ges. April 28th, 1934. (439345.)

13797. "Electric welding systems." British Thomson-Houston Co., Ltd. May 10th, 1934. (439461.)

17058. "Cathode-ray tubes." Fernseh Akt.-Ges. June 13th. 1934. (439414.)

17299. "Thermostatic electric switches." British Thomson-Houston Co., Ltd. June 16th, 1934. (439468.)

18685. "Coreless induction furnaces." J. T. Shevlin (Siemens & Halske Akt.-Ges.). June 29th, 1935. (439472.)

19686. "Joints for high tension electric cables." Soc. Italiana Pirelli. January 30th, 1935. (Addition to 372169.) (439473.)

23951. "Electrolytic condensers." C. D. Gwinn, F. C. Stephan and Telegraph Condenser Co., Ltd. August 27th, 1935. (439479.)

24077. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. August 29th, 1934. (439481.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 27th:—

Noral (lettering and design). No. 564341. Class 5. Sheet aluminium and aluminium castings.—The Northern Aluminium Co., Ltd., Bush House, Aldwych, London, W.C.2.

RTE (lettering and design). No. 559486. All goods in Class 8.—Radio Transmission Equipment Co., Ltd., 54, Vicarage Lane, Ilford, Essex.

Courier. No. 563768. All goods in Class 8.—The Peto Scott Co., Ltd., 77, City Road, London, E.C.1.

Vi-Tan. No. 562280, and Vi-Tan Ultra Violet Home Unit (lettering and design). No. 562282. Class 8. Mercury-vapour lamps for curative purposes.—The Thermal Syndicate, Ltd., Neptune Bank, Wallsend-on-Tyne.

Micatric. No. 563464. Class 50. Mica in shaped pieces for use as electrical insulators.—Copeland and Jenkins, Ltd., Elektron Works, Norlington Road, Leyton, London, E.10.

Permaplastic. No. 563864. Class 50. Compositions prepared from condensation products of phenol and formaldehyde sold in solid, plastic or moulding powder form and articles made from such compositions.—Permastic, Ltd., Woodham Works, 20, King's Road, New Haw, near Addlestone, Surrey.

Boulder Power House Nearing Completion

Electrical West reports that the construction of the Boulder Dam power house is virtually completed and the initial machinery is now being installed for the first production of power which will be late in the summer of 1936. On November 20th the power house structure had been finished except for the final pour of concrete on the roof and the placing of windows. Four of the 115,000-h.p. turbines and one of the 55,000-h.p. turbines are being installed at the present time. Two of the turbine scroll cases have been completed. Two of the armatures for the generators had been received and were being assembled. The installation of the penstock pipe will not be completed until May, however. On November 15th the lake back of the dam was 79 miles in length, having receded six miles since the high recording on July 31st.